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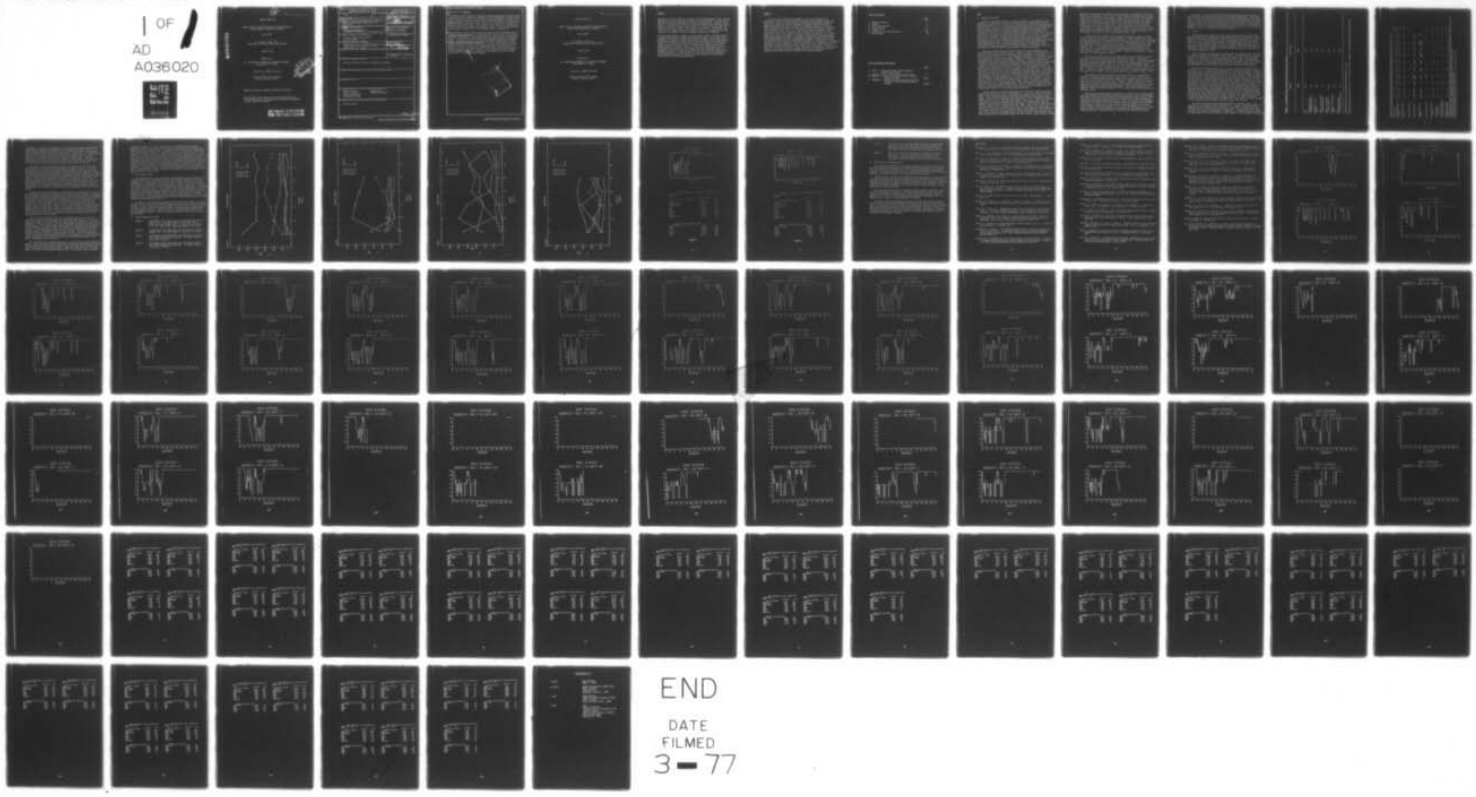

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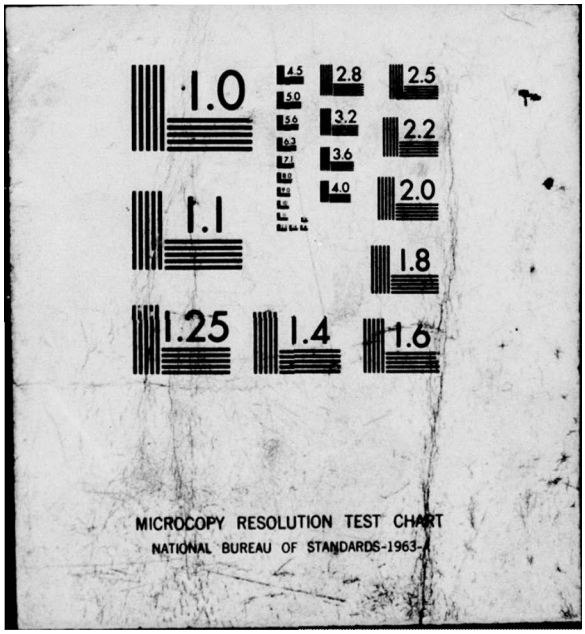
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REPORT NUMBER TWO

ANALYSIS OF ELECTROENCEPHALOGRAPHIC RECORDS OBTAINED DURING HEROIN WITHDRAWAL IN VIETNAM

FINAL REPORT

Dr. Richard C. Howe, Ph.D.
Department of Physiology and Bioengineering

22 April 1976

Supported by

U.S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
Washington, D.C. 20314

Contract No. DAMD17-75-C-5030

Eastern Virginia Medical School
Norfolk, Virginia 23507

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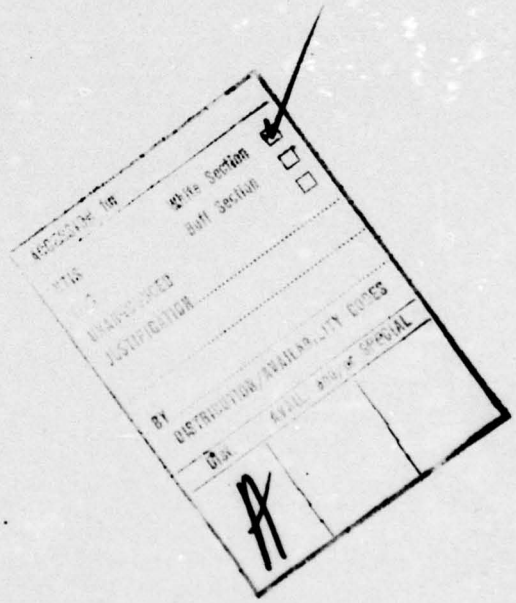
The purpose of this study was to analyze electroencephalographic (EEG) records obtained from heroin dependent individuals during withdrawal. The EEG records were analyzed for various awake and sleep states according to standard techniques. The records were scored on a minute to minute basis into awake, awake with alpha rhythm, slow wave sleep stages I, II, III, and IV, and rapid eye movement (REM) sleep states. From a total of 25 subjects, five control subjects and four patients have been analyzed to date. All scored EEG data were transferred to computer files for subsequent analysis and plotting.

The preliminary results indicate that the control subjects exhibited fairly standard sleep patterns in that they showed the typical "first night effect" (a general disruption of sleep associated with a suppression in the amount of REM sleep) followed by a stabilization of the sleep patterns on consecutive nights. The percentage of the various sleep-waking states for the control subjects were within normal values. The patients undergoing heroin withdrawal displayed a definite disruption in the total sleep pattern which was characterized by an increase in the awake and awake plus alpha states, a decrease in some of the slow wave sleep states, and a greater suppression of the REM sleep state. Further analysis of the EEG data from the remaining heroin dependent patients is necessary to more adequately describe these alterations in the sleep-waking patterns.



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SUMMARY

The purpose of this study was to analyze electroencephalographic (EEG) records obtained from heroin dependent individuals during withdrawal. The EEG records were analyzed for various awake and sleep states according to standard techniques. The records were scored on a minute to minute basis into awake, awake with alpha rhythm, slow wave sleep stages I, II, III, and IV, and rapid eye movement (REM) sleep states. From a total of 25 subjects, five control subjects and four patients have been analyzed to date. All scored EEG data were transferred to computer files for subsequent analysis and plotting.

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FORWARD

Several studies have been in progress over the past several years investigating biorhythmic phenomena in drug abuse, substitution therapy, and abstinence. One such study, conducted in 1972 by the Department of Experimental Psychophysiology, Walter Reed Army Institute of Research (Project 3A062110A823, Work Unit 032), involved the continuous monitoring of physiological systems during withdrawal from heroin in military personnel stationed in the Republic of Viet Nam. This research project was conducted at the 24th Evacuation Hospital, Long Binh Post, between April and June of 1972 by members of a field research team from Walter Reed. During this study, several electrophysiological parameters were obtained including electroencephalogram (EEG), electrooculogram (EOG), electromyogram (EMG), electrocardiogram (EKG), electrophneumogram (EPG), and electrogastrogram (EGG). The EEG and EOG data are critical in the analysis of sleep-waking states in an individual. In addition, knowledge of these behavioral states is essential in the interpretation of the other physiological parameters, such as heart rate, respiration, and gastric motility, also collected in this study. Therefore, the purpose of this research project was to analyze the EEG records obtained in the above study for EEG patterns and/or abnormalities associated with heroin withdrawal.

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BODY

1. General Background

Within the past several years, a variety of studies have focused upon the general area of drug abuse, addiction, and withdrawal. Investigations of biorhythmic phenomena related to drug abuse, substitution therapy and abstinence have been conducted in animals, in the civilian addict population and in the military. One such study, conducted by the Department of Experimental Psychophysiology, Walter Reed Army Institute of Research (Robinson et al. 1972), involved the continuous monitoring of multiple physiological systems during withdrawal from heroin in military personnel stationed in the Republic of Viet Nam. This research project was conducted at the 24th Evacuation Hospital, Long Binh Post, between April and June of 1972 by members of a field research team from Walter Reed. During this study, several electrophysiological parameters were obtained including electroencephalogram (EEG), electrooculogram (EOG), electrocardiogram (EKG), electrophneumogram (EPG), and electrogastrogram (EGG). The purpose of this research project was to analyze the EEG records obtained in the above study for EEG patterns and/or abnormalities associated with heroin withdrawal.

Physiology, pharmacology and clinical aspects of heroin dependence have been well examined in civilian patients. However, the heroin using population in Viet Nam differed substantially from these civilian groups in several ways (Robinson et al. 1974 a, b, c). Heroin dependent individuals in the United States use a wide range of drugs concurrently, administer the drugs intravenously, and have lengthy and complex drug and medical histories. The drugs obtained are relatively impure and frequently contain other pharmacologically active adulterants. In addition, the opiate abstinence syndrome has often been obscured by pharmacological intervention to alleviate discomfort. It has also been difficult to ascertain the direct effects of heroin as opposed to the effects of disease and malnutrition associated with heroin dependence in the United States. In contrast, the majority of heroin users in Viet Nam seldom consumed other drugs while using heroin and administered the drug by nasopulmonary routes (smoking as an admixture with tobacco or forceful inhalation of the crystalline drug into the nostrils). The Viet Nam heroin user generally had no prior experience with heroin or other opiates (Robins, 1973) and hence did not have a complex drug history. Heroin in Viet Nam was of very high purity (92-98%) (Baker, 1972). Abstinence symptoms were relatively mild in these young heroin users who appeared to be considerably healthier than the stateside heroin addict. Thus, the Viet Nam heroin user provided an inadvertent model to study the effects of pure heroin without many of the problems inherent to the civilian addict population.

Several studies have observed the presence of biological rhythms in physiological and behavioral activities (Crowley et al. 1972; Fort, Mills, 1972; Hauty, Smith, 1972; Hildebrandt, Engel, 1972; Hockey, Colquhoun, 1972; Tanquay et al. 1973). Some of these ultradian oscillations were initially described in sleep (Dement, Kleitman, 1957; Kleitman, 1969; Webb, Agnew, 1967). Dement and Kleitman (1957) were the first to show that EEG activity, rapid eye movements and body movements all exhibited a 90-100 minute cycle due to alternation of rapid eye movement (REM) sleep and non-REM (slow wave) sleep. This has since been confirmed in other studies (Globus, 1970; Globus et al. 1973; Kripke, 1972; Lubin et al. 1973; Lucas, Sterman, 1975; Naitoh et al. 1973). More recently it was postulated that the 90 minute REM sleep cycle was a reflection of the basic rest-activity cycle (BRAC) occurring throughout the 24 hour day (Kleitman, 1969; Sterman, 1972). Several investigations have given support to this position. Webb and Agnew (1967)

observed a 24 hour cycling of REM and slow wave sleep. Ultradian oscillation in EOG activity (Howe et al. 1973; Kripke, 1972), EMG activity (Globus et al. 1973; Kripke, 1972), gastric activity (Hiatt, Kripke, 1972) and in heart rate (Aldredge, Welch, 1973; Kripke, 1972; Orr, Hoffman, 1974) have been reported. In a study measuring the periodicity within sleep (the REM cycle) and waking (performance cycles), no significant difference was found between the REM sleep cycle and performance cycle (Sterman et al. 1972). Thus, the presence of an ultradian 90-100 minute rest-activity cycle occurring throughout the 24-hour day has been established as a fundamental aspect of central nervous system physiology. Further speculations have been made that the REM sleep cycle is really a manifestation of the basic rest-activity cycle during sleep (Sterman, 1972).

In considering the relationship of biological rhythms to sleep, two fundamental cycles must be examined - the REM sleep cycle (approximately 90 minutes) and the sleep-waking cycle (approximately 25 hours). Poor sleep is not only marked by frequent awakenings, but frequent shifts in the EEG sleep stages also occur and the usual 90-100 minute cycle is no longer seen. This disruption of the sleep cycle has been clearly demonstrated in the chronic alcoholic during withdrawal (Johnson, 1973). It was suggested that the disruption of these cycles may be more relevant to waking behavior than the total amount of wakefulness or time spent in sleep stages. The question remains as to what are the effects of heroin withdrawal on these biological rhythms.

The effect of opiate drugs on the central nervous system has been examined quite well in animals (Colasanti et al. 1975; Echols, Jewett, 1972; Khazan, Colasanti, 1971, 1972; Nash et al. 1973; Young et al. 1975). In morphine dependent rats upon withdrawal, both the duration and mean EEG voltage output of REM sleep episodes declined to minimal levels the first day and remained below control levels up to the third day (Colasanti et al. 1975; Khazan, Colasanti, 1972). This was followed by a rebound in REM sleep time above control levels up to the 12th day. In the cat, a single dose of morphine was shown to increase wakefulness and to suppress both non-REM (slow wave) sleep and REM sleep (Echols, Jewett, 1972).

The suppressant effect of opiates on sleep and REM sleep in experimental animals has also been demonstrated in human studies. Kay et al (1969) found evidence of a delayed rebound excess of REM sleep subsequent to the initial suppression resulting from an acute dose of morphine. After self-administration of heroin for up to seven days, Lewis et al. (1970) reported a suppression of REM sleep and an increase in drowsiness during the drug administration period and an immediate increase in REM sleep upon withdrawal. It was also noted that the rebound in REM sleep remained evident for two to three months following the acute withdrawal phase.

During chronic administration of morphine, Kay (1973; 1975) noted that REM sleep was significantly decreased during both the induction and the stable phase. The number of REM sleep episodes remained low and the REM sleep cycle was longer in duration during both phases, while the mean REM sleep episode duration was diminished only during the induction phase. Thus, in a chronic heroin dependent individual, the number of REM sleep episodes should be decreased, the REM sleep cycle should be increased, but the duration of each REM epoch should be near control values. This would suggest a direct effect of morphine upon the central nervous system mechanism responsible for the REM sleep cycle which may be, as mentioned earlier, a reflection of the ultradian basic rest-activity cycle.

Therefore, in order to study the effects of morphine upon these cycles, it is necessary to examine data obtained on a continuous 24-hour basis. The human data described above were obtained only during nightly recording sessions. This study is unique in that the data were collected on a continuous 24-hour basis for up to six consecutive days, thus permitting an analysis of the effects of heroin withdrawal upon these various biological rhythms. As the EEG is an indicator of behavioral states, it can be used to examine the alterations in the sleep-waking and REM sleep cycle associated with heroin withdrawal.

2. Methods

The methodological objective of this research project was to analyze EEG data obtained from heroin dependent individuals during acute withdrawal. These data were from twenty patients and five drug-free control subjects and totaled 2,602 hours of continuous recording time. The demographic data and heroin use history for these subjects have already been published (Robinson et al. 1974a, b, c) and is summarized in Tables I and II. The EEG and EOG data from four patient and five control subjects have been analyzed to date. Parts of the EKG and EOG data have been analyzed by other investigators originally involved in this study (Hegge et al. 1973).

The EEG records were analyzed for various awake and sleep states according to standard techniques (Rectschaffen, Kales, 1968). The EEG data were scored on a minute by minute basis into awake, awake with alpha rhythm, slow wave sleep stages I, II, III, and IV, and rapid eye movement (REM) sleep. An "undefined" category was also used for those time intervals where the EEG signal was missing or uninterpretable. Independent reading and cross checking of the scores was also performed in order to control the quality and accuracy of the EEG data.

During the recording of these data, a monopolar EEG lead referenced to an EOG lead was used. These leads also detected EMG activity from the head muscles. Thus, EEG, EOG, and head EMG were multiplexed on the same data channel. As the frequency range of EMG is considerably higher than EOG and EEG, bandpass filtering was performed during playback of these data onto paper records in order to remove the EMG activity. Further separation of the EOG and EEG activity by filtering is not possible, as their frequency bands overlap. However, amplitudes of these physiological parameters differ considerably in that EEG is in the microvolt range and EOG is in the millivolt range. By decreasing the gain during playback, it was possible to retain the EOG activity while totally suppressing all EEG signals. Thus, during playback of the multiplexed signals from magnetic tape to paper records, three channels were recorded: 1) the raw unfiltered multiplexed signal with EMG, 2) the filtered EEG channel with EOG, and 3) the filtered EOG channel. Standard sleep EEG records should contain one EEG channel, two EOG channels, and an EMG channel (Rectschaffen, Kales, 1968). However, the usefulness of the EMG in scoring sleep states has been criticized recently as it tends to be more closely associated with body position rather than sleep stages. The data obtained in this study have one EEG channel, one EOG channel, and some EMG.

The major difference between standard techniques and those used in this study was in the placement of the EEG electrodes. Standard sleep EEG records are obtained from electrodes placed at the C_3 or C_4 positions and referenced to an indifferent ear electrode on the contralateral side. This placement was selected to more clearly detect sleep spindles, K complexes, and vertex sharp waves which are used primarily in scoring Stage II sleep. However, in this study, the detection

TABLE 1. Comparative Data on Viet Nam Heroin Users vs. Controls

	Controls	Heroin Users
	Mean	Mean
Age	22.2	20.3
Completed years of secondary education	14.2	11.6
Population of home town[1]	$>10^4$	$>10^5$
Months served in Viet Nam before study	4.3	5.6
Months of remaining military service	< 13.2	< 12.0
Frequency of marijuana use[2]	11.2	6.3
Weight loss during Viet Nam tour (pounds)	7.0	16.5

[1] during the four years immediately preceding military service

[2] expressed as days between use (e.g. 6.3 = marijuana smoked slightly more frequently than one time each week)

TABLE 2. Drug History, Heroin Use History, and Pattern of Previous Attempts at Withdrawal for Ten Heroin Users

Subject Number	1	3	4	5	13	14	15	22	23	24	Mean
Age at initial drug abuse	17-18	13-14	17-18	17-18	19-20	17-18	17-18	15-16	17-18	15-16	16.9
Age at initial heroin use	18-19	18-19	18-19	20-21	23-24	20-21	18-19	18-19	18-19	18-19	19.4
Months of heroin use	5	1	3	8	5	5	4	2	6	3	4.2
Initial heroin route	smoke	snort	smoke	smoke snort	smoke	smoke	smoke	smoke	smoke	smoke	
Route of last heroin dose[1]	smoke	snort	IV	smoke	smoke	smoke	smoke snort	smoke	smoke snort IV	IV	
Vials of heroin daily[2]	6	2	2	(4-8)[3]	10	6	2	4	2	1	4.1
Amount of last dose in vials[2]	0.5	0.5	0.5	0.5	1	0.5	2	3	2	2	1.2
Hours since last heroin dose[1]	<4	<1	<3	<3	<1	<1	<1	<1	<1	<1	<1.7
Numbers of attempts to withdraw in the past	1	1	10	4	3	0	3	2	1	0	3.1
Duration of previous abstinence syndrome	48	72	96	72	48	0	156	48	72	0	76.5

[1] "last heroin dose" refers to the dose taken immediately before entering the research ward; all patients self-administered their last dose of heroin by the same route or combinations of routes regularly used over the preceding month

[2] one vial equals approximately 250 mgm of 92-98% pure heroin

[3] heroin was used intermittently by this patient, heavily in the rear areas and none in combat

of wakefulness was just as important as sleep, especially during early withdrawal where sleep is suppressed and wakefulness is enhanced. The alpha rhythm, an 8-12 Hz EEG pattern recorded primarily from the occipital cortex, is associated with an awake individual usually with eyes closed. Furthermore, it was anticipated that during early withdrawal the patients would attempt to sleep but would be unable, i.e., would be in bed with eyes closed, but still awake. The best approach in evaluating this state is to record the alpha rhythm. Therefore, the EEG electrode was placed over the occipital cortex in the standard O_2 position from which both alpha rhythm and general EEG patterns could be recorded.

As stated in an earlier quarterly report, the analysis of the EEG records progressed slower than initially estimated due to several factors. First, the EEG signals were recorded using a non-standard placement of the EEG electrodes, the O_2 position to a frontal indifferent. These positions were selected in order to multiplex EOG and EEG signals on the same telemetry channel and to better record the occipitally located alpha rhythm associated with an awake individual with eyes closed. This non-standard placement of the EEG electrodes was not suitable for clearly recording sleep spindles, K complexes and vertex sharp waves. These particular EEG patterns are used in scoring stage II sleep which normally occupies approximately 50% of a normal sleep record. Because many of the EEG records in this study did not possess these typical EEG patterns associated with sleep, the interpretation and reading of the EEG records was considerably more difficult and slower.

Another factor that contributed to the difficulty in reading the EEG records was gain changes associated with physical displacement of the telemetry transmitters by the subjects during the initial recording. The scoring of EEG data is dependent not only upon particular EEG patterns but also upon the amplitude of these signals. For example, the amplitude of the EEG normally increases as an individual progresses from Stage I to Stages II, III, and IV slow wave sleep, then decreases considerably in the REM sleep state. In addition, body movements or position changes, such as rolling over, normally occur in sleep during transitional periods between the major sleep states. Many of the subjects in this study likewise displayed changes in body position during sleep which was sometimes associated with amplitude changes in the EEG. In order to compensate for these amplitude changes, it was necessary to read the EEG records both forward and backward to properly interpret the various sleep states.

A third but less important factor that increased the data reduction time involved the analysis of the records into the standard EEG states. In the initial research protocol, it was stated that the records would be scored into four main categories: awake (no alpha), awake with alpha rhythm, non-REM sleep (Stages I-IV), and REM sleep. These results would then be different from that normally reported in the literature, thus making their interpretation considerably more difficult. Therefore, it was decided to attempt to score all of the EEG states in the first several subjects to determine if this was even possible. In spite of the non-standard electrode placement and gain problems, analysis of the EEG records into all of the standard sleep states was possible. The scoring of all these behavioral states increased the data reduction time but added considerable meaning to the overall interpretation of the results.

The scored EEG data was then collated on the computer into continuous 24-hour blocks. The raw scored minute by minute EEG data was first punched onto paper tape, using an appropriate alpha-numeric code for each behavioral state, and then read into the computer into 24-hour data blocks (1440 data values per day). The paper tapes also served as the permanent backup records. The 24-hour data blocks were

smoothed and plotted for visual inspection of the behavioral state changes. Percentages of the various behavioral states was calculated for both addict and control groups on a 24 hour basis. The purpose of this analysis was to determine the relative time a subject is in each state during a day as well as across days. Total time in minutes was also summated for these various time intervals. Since the minute by minute data for the subjects for the total recording time is available on the computer, any time interval (other than those mentioned above) could be examined for the various awake and sleep states. Programs were developed to merge the 24-hour data blocks into single continuous data files for the entire recording time (5-7 days), to recode the raw alpha-numeric files into 24-hour data files (1440 data values per day), to calculate the percentages of the various behavioral states over a 24-hour interval, to calculate the percentages of the sleep states only, to smooth the data files, and to plot the files for visual examination of the EEG states over a complete day.

3. Preliminary Results

As mentioned earlier, only a portion of the EEG data has been analyzed. Preliminary results from the EEG data indicate that the percentages of the various sleep states for the control subjects were within normal values over consecutive recording days. In addition, the controls showed a typical "first night effect", i.e. a general disruption of sleep and decrease in several sleep stages, including REM sleep. Figures 1 and 2 display the percentages of the sleep states over several days for two control subjects. In contrast to this, the heroin dependent patients during withdrawal showed definite changes in sleep characterized by an increase in awake plus alpha rhythm and stage I and a decrease in slow wave sleep stage II (Figures 3 and 4). One patient (Figure 3) showed a marked suppression of REM sleep across all days, whereas the other patient (Figure 4) only showed a decrease in the amount of REM sleep on days 3 and 5.

In addition, the sequential patterning of these behavioral states across the 24 hour day was considerably different between the control and heroin user subjects (Figures 5 and 6). The control subjects tended to sleep during a continuous block of time, whereas the heroin dependent patients during withdrawal showed attempts to sleep throughout the day. Further analysis of the data from the remaining heroin dependent subjects is required to make any definite conclusions regarding these results.

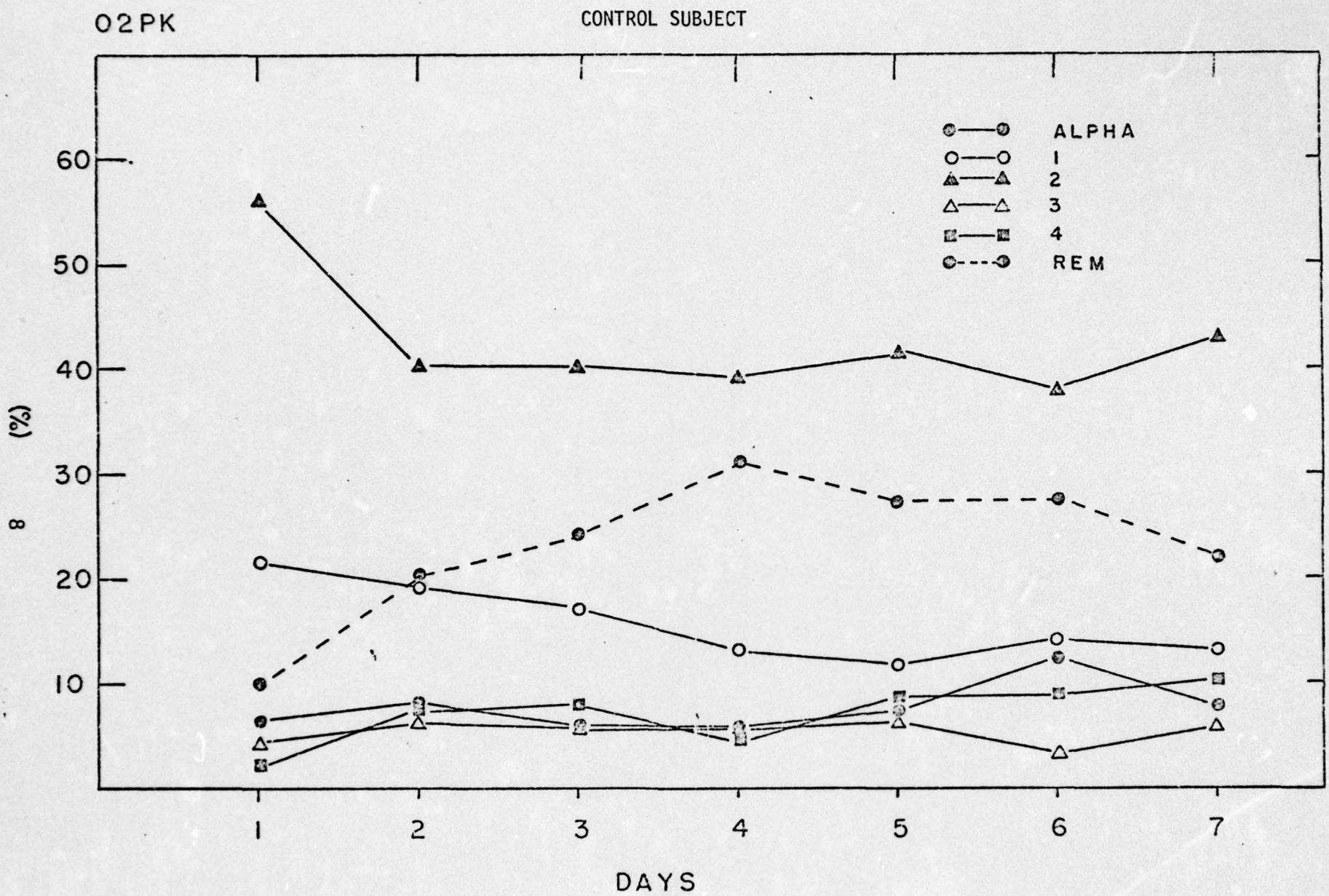
4. Figure Legends and Figures

Figure 1 — Percentages of the sleep states over seven days for control subject 02PK. The symbol legend is as follows: alpha = awake plus alpha rhythm state; 1-4= Slow wave sleep stages I, II, III, and IV; REM = Rapid Eye Movement sleep state.

Figure 2 — Percentages of the sleep states over five days for control subject 11WB. The symbol legend is the same as in Figure 1.

Figure 3 — Percentages of the sleep states over seven days for heroin user subject 01BJ during withdrawal. The symbol legend is the same as in Figure 1.

Figure 4 — Percentages of the sleep states over five days for heroin user subject 03MD during withdrawal. The symbol legend is the same as in Figure 1.


02PK
CONTROL SUBJECT
ALPHA
1
2
3
4
REM
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50
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30
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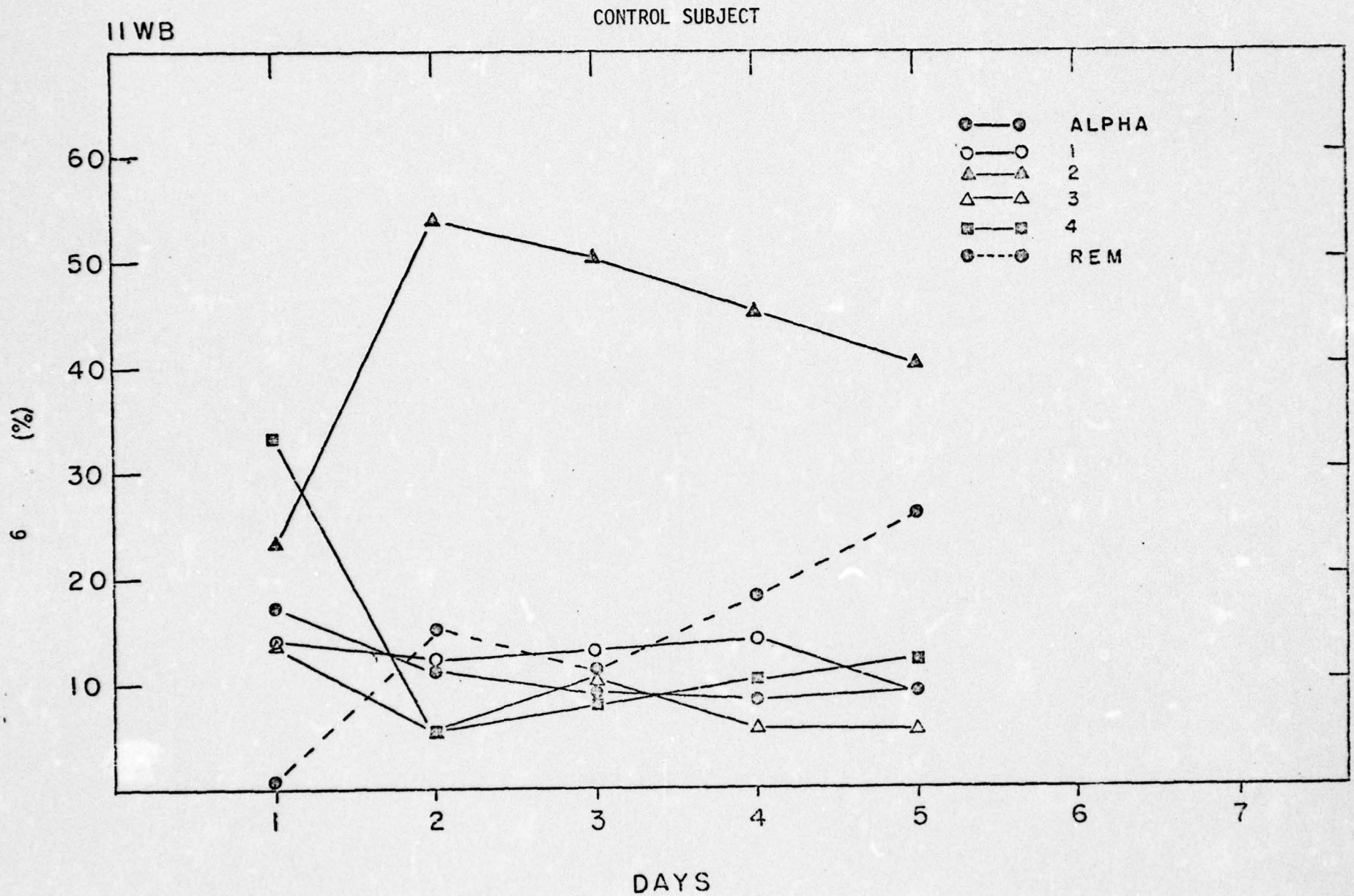
10
8 (%)
1
2
3
4
5
6
7
DAYS

FIGURE 1


11WB
CONTROL SUBJECT
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DAYS

FIGURE 2

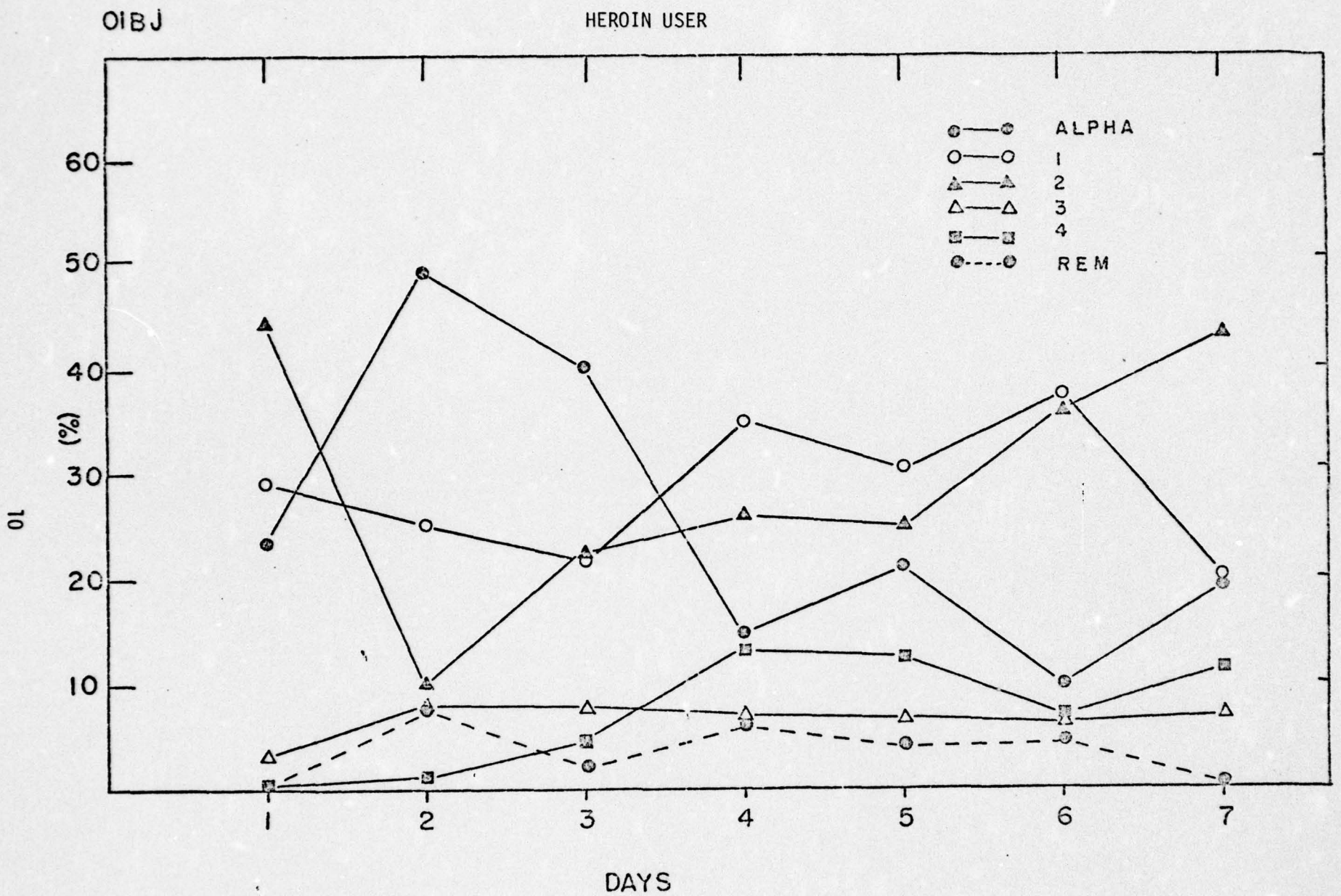
01BJ
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FIGURE 3

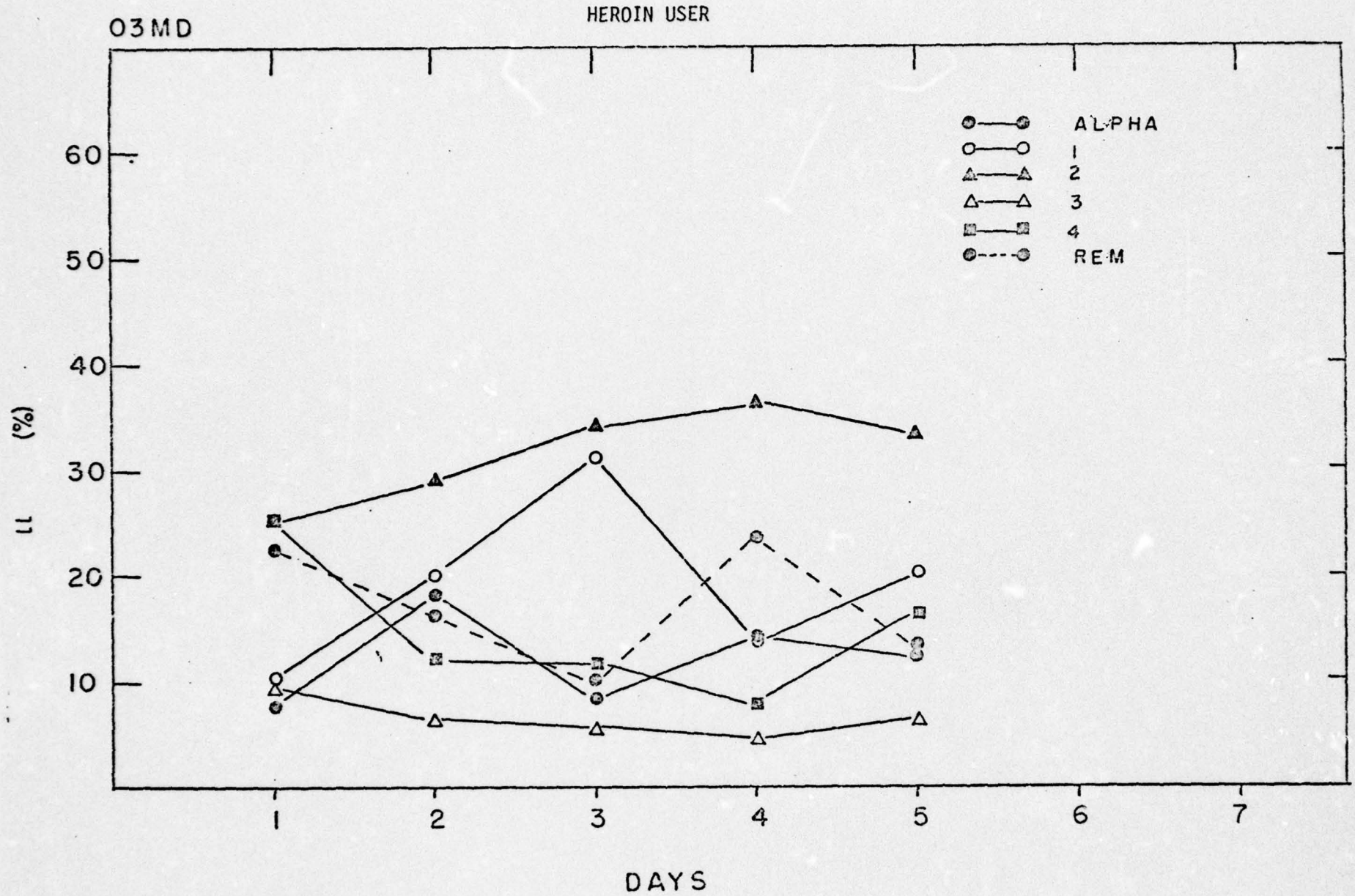
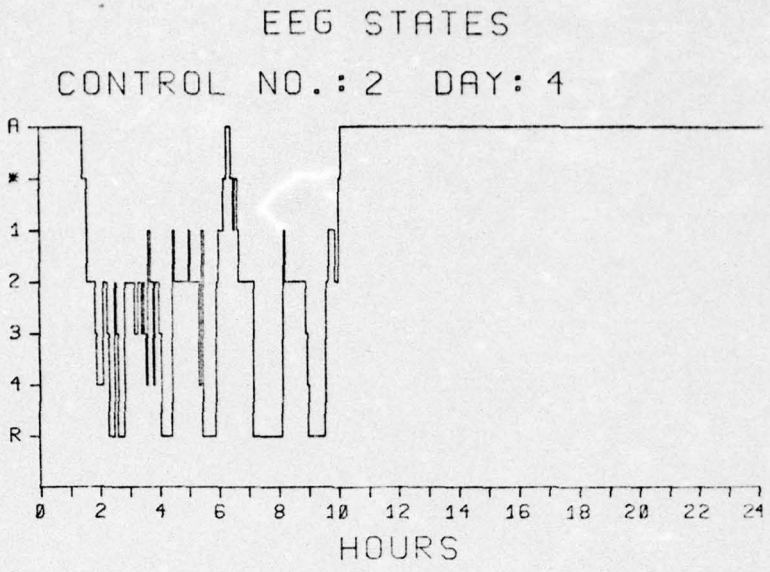


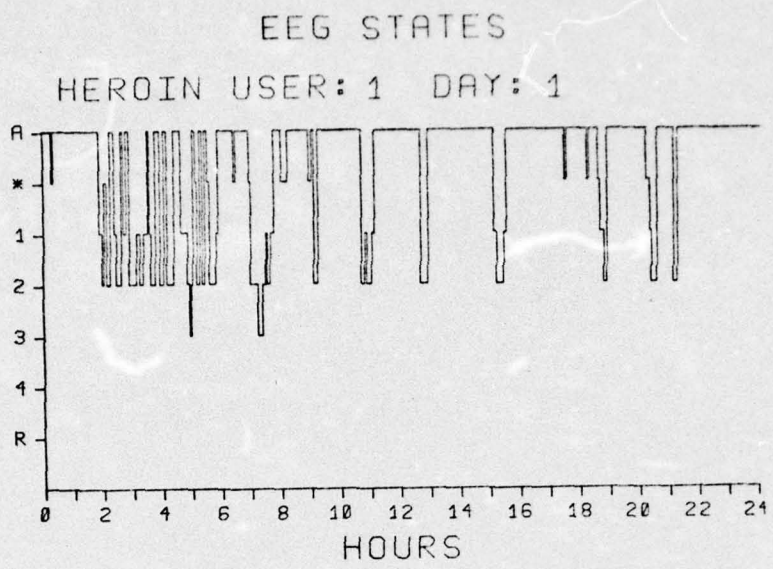
FIGURE 4



STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 4

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	65.07	937.
TOTAL SLEEP	34.93	503.
AWAKE ALPHA	1.87	27.
ONE	4.58	66.
TWO	13.61	196.
THREE	2.29	33.
FOUR	1.60	23.
REM	10.97	158.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	5.37	27.
ONE	13.12	66.
TWO	38.97	196.
THREE	6.56	33.
FOUR	4.57	23.
REM	31.41	158.

FIGURE 5



STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	70.28	1012.
TOTAL SLEEP	29.72	428.
AWAKE ALPHA	6.94	100.
ONE	8.61	124.
TWO	13.26	191.
THREE	0.83	12.
FOUR	0.07	1.
REM	0.00	0.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	23.36	100.
ONE	28.97	124.
TWO	44.63	191.
THREE	2.80	12.
FOUR	0.23	1.
REM	0.00	0.

FIGURE 6

Figure 5 Plot of the awake and sleep states for control subject 02PK, recording day 4. The table in the lower part contains the behavioral state percentages and time in minutes for the same subject based on 24 hours and based on total sleep only.

Figure 6 Plot of the awake and sleep states for heroin user subject 01BJ, day 1. The table in the lower part contains the behavioral state percentages and time in minutes for the same subject based on 24 hours and based on total sleep only.

5. Conclusions and Recommendations

The information collected in this heroin withdrawal study is unique in that the drug dependent individuals were using pure heroin and the data were collected on a continuous 24-hour per day basis. This type of information has never been collected in any other drug study to date. The analysis of these data is extremely important in the understanding of drug dependence and withdrawal.

The EEG records from the control subjects are also important in determining how the sleep-waking patterns of a normal individual are affected by a hospital ward environment and how these patterns adjust or change over time. The records obtained from the addict group will permit an in-depth analysis of the alterations in the sleep-waking patterns associated with the acute phase of heroin withdrawal and the beginning of the recovery phase.

The other physiological data collected from the withdrawal study will assist in the interpretation of the effects of heroin withdrawal upon several autonomic nervous system related functions, such as heart rate, respiration and gastric motility. The results of this and other related studies may provide a means for improving the prognosis of heroin dependent individuals.

In summary, considerable progress was made this year both in the scoring of the EEG records and in the development of the computer programs to process these data. As mentioned earlier, nine out of 25 subjects were completed, which included four heroin dependent patients and five control subjects. However, in order to make any meaningful conclusions regarding the sleep and waking patterns associated with heroin withdrawal, it would be necessary to complete the analysis of the remaining heroin dependent subjects.

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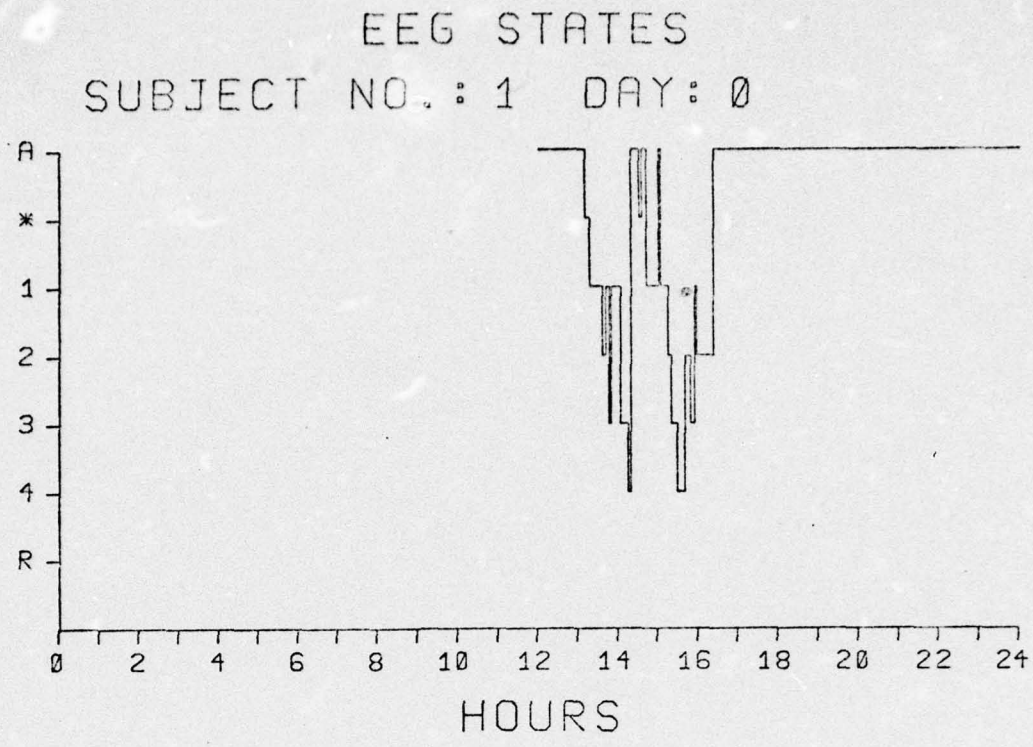
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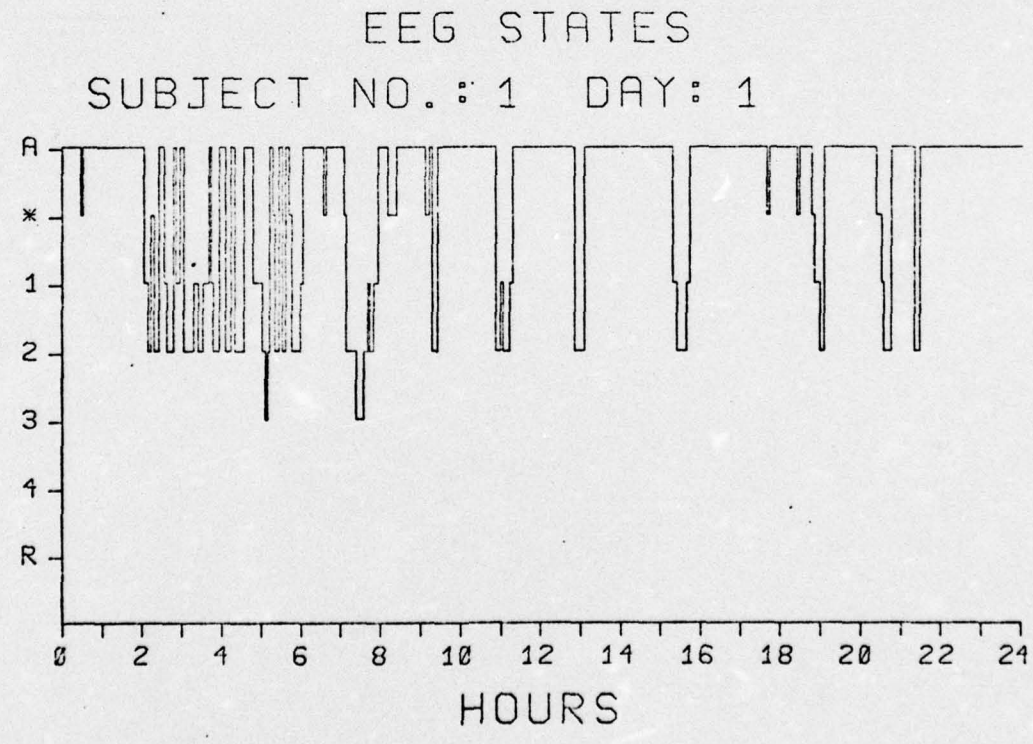
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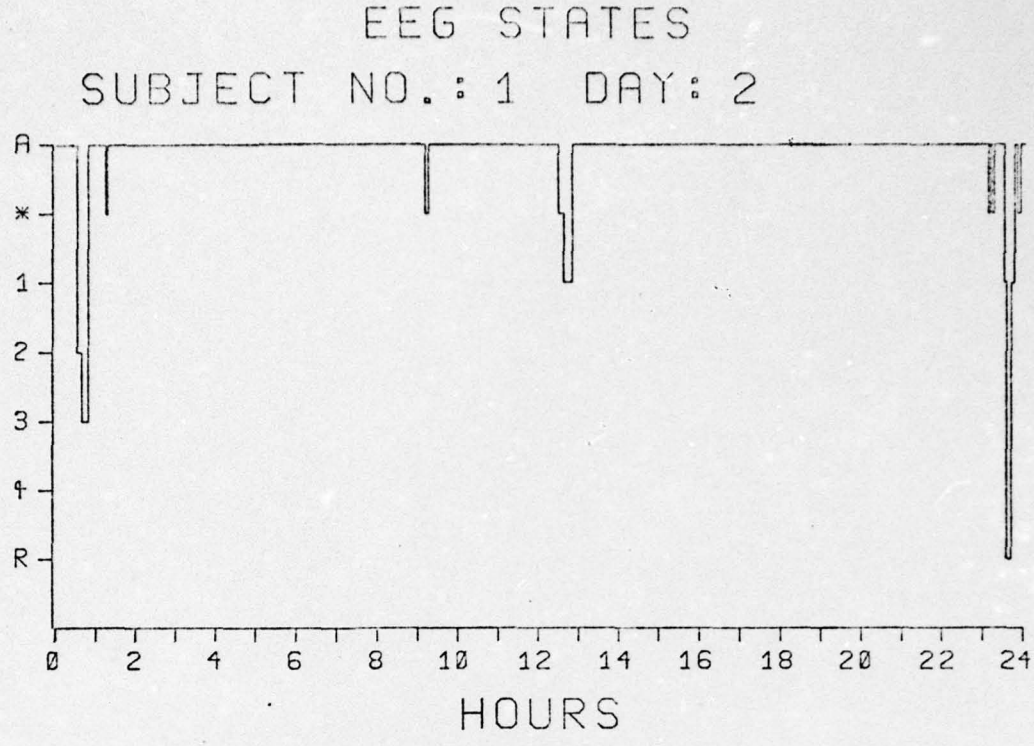
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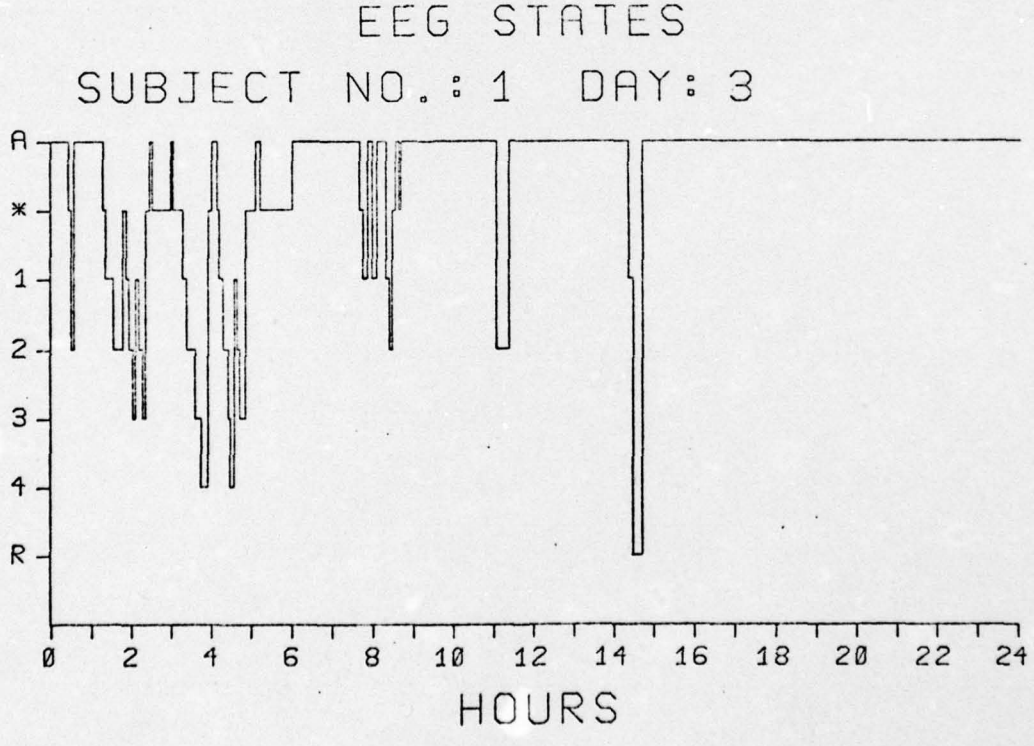
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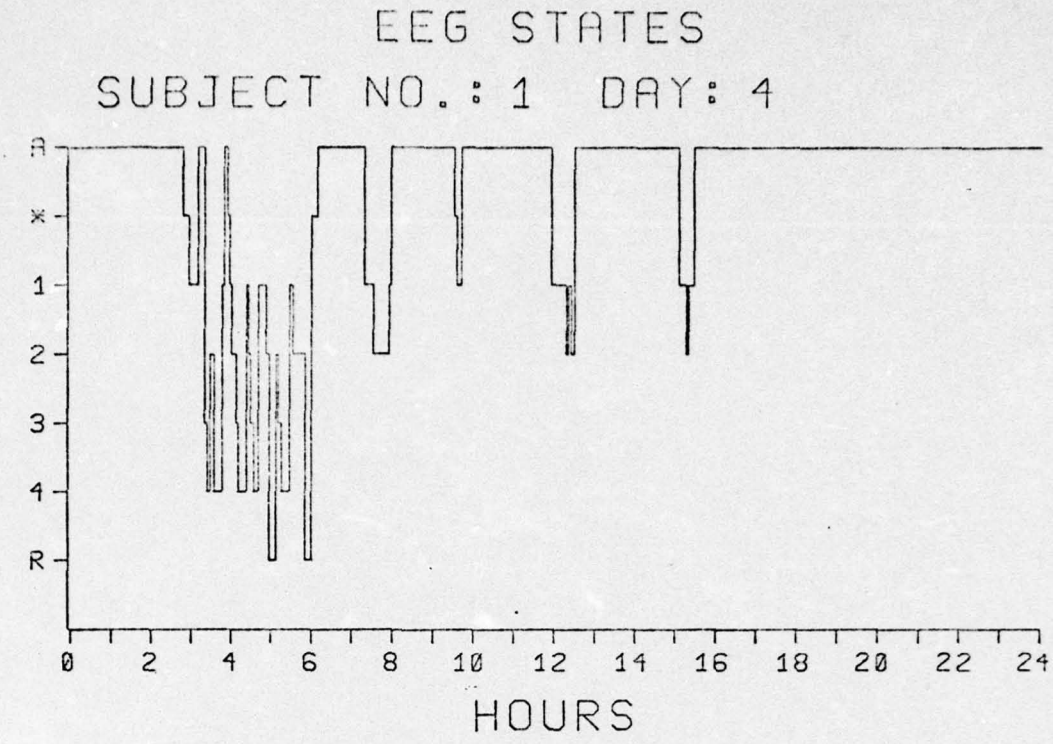
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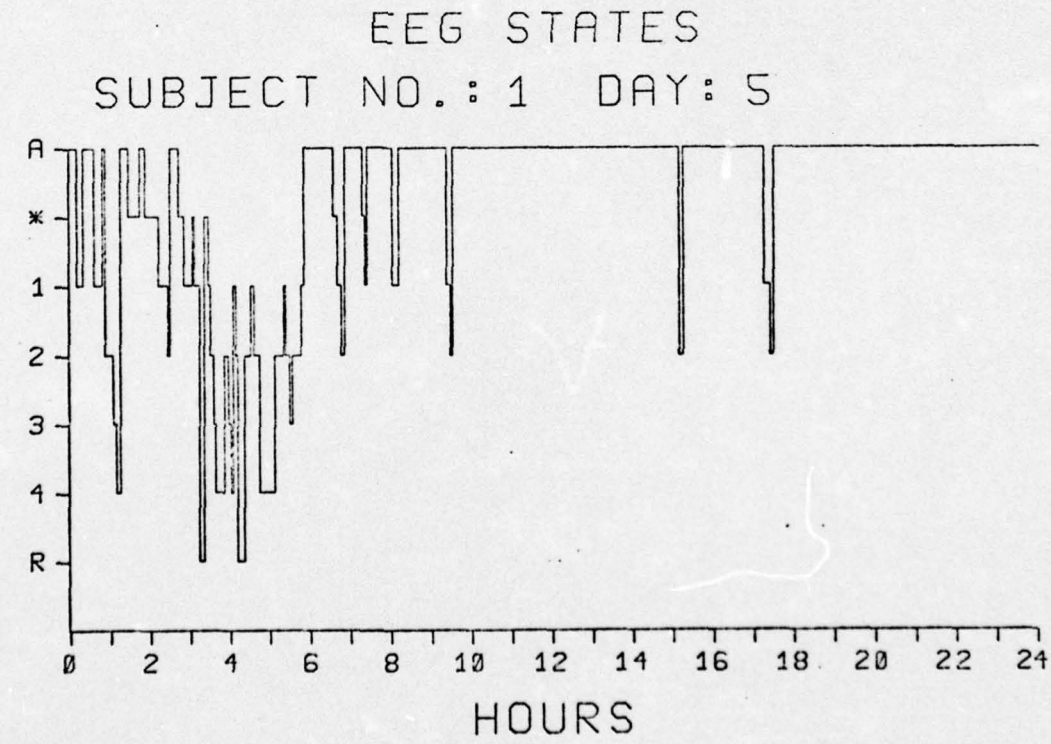
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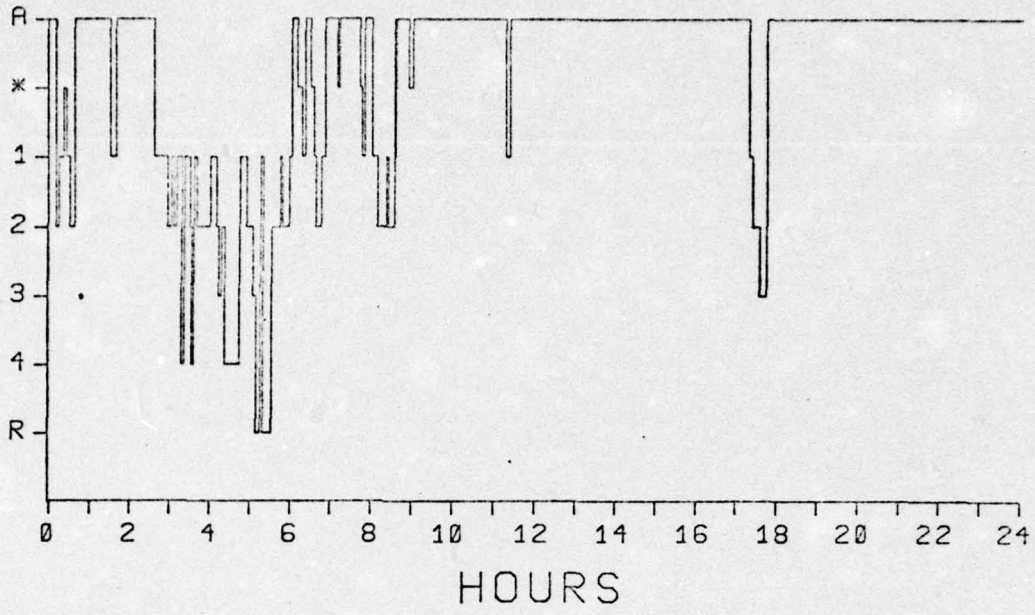

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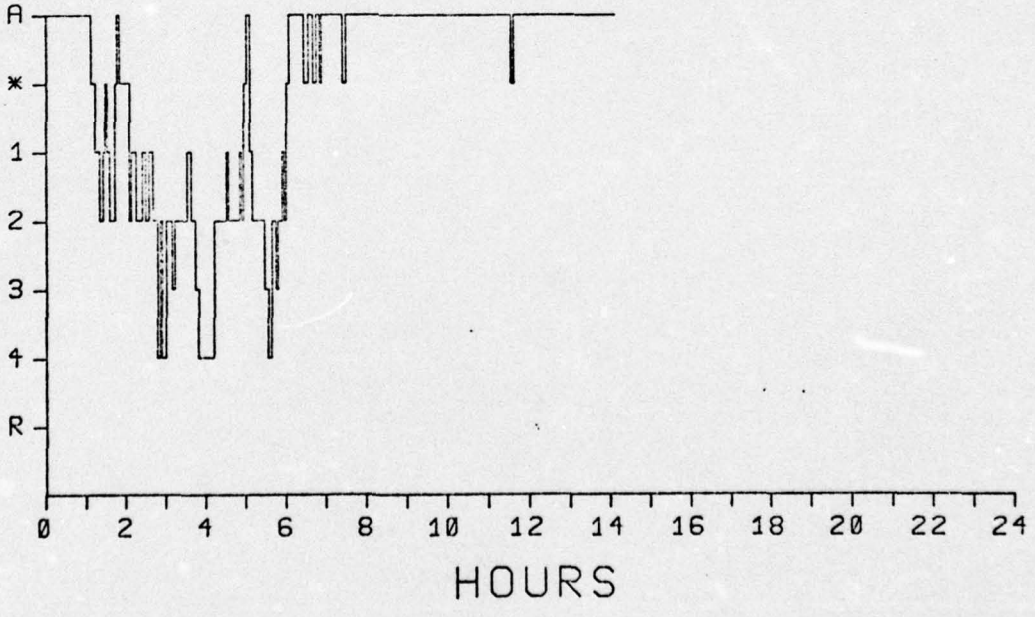

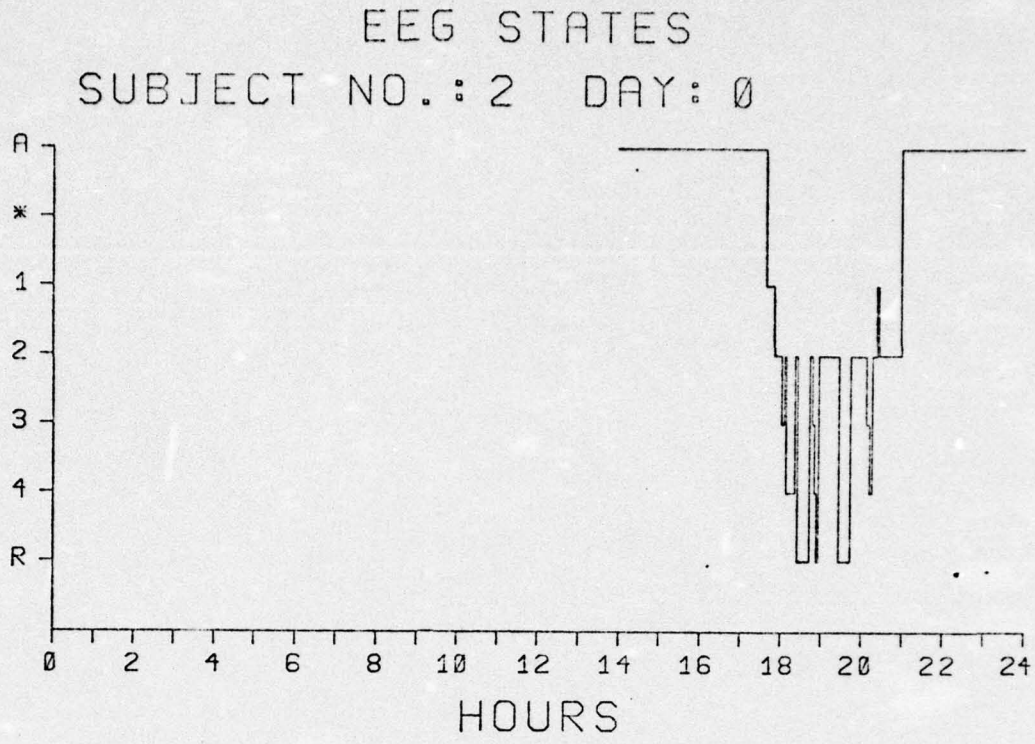
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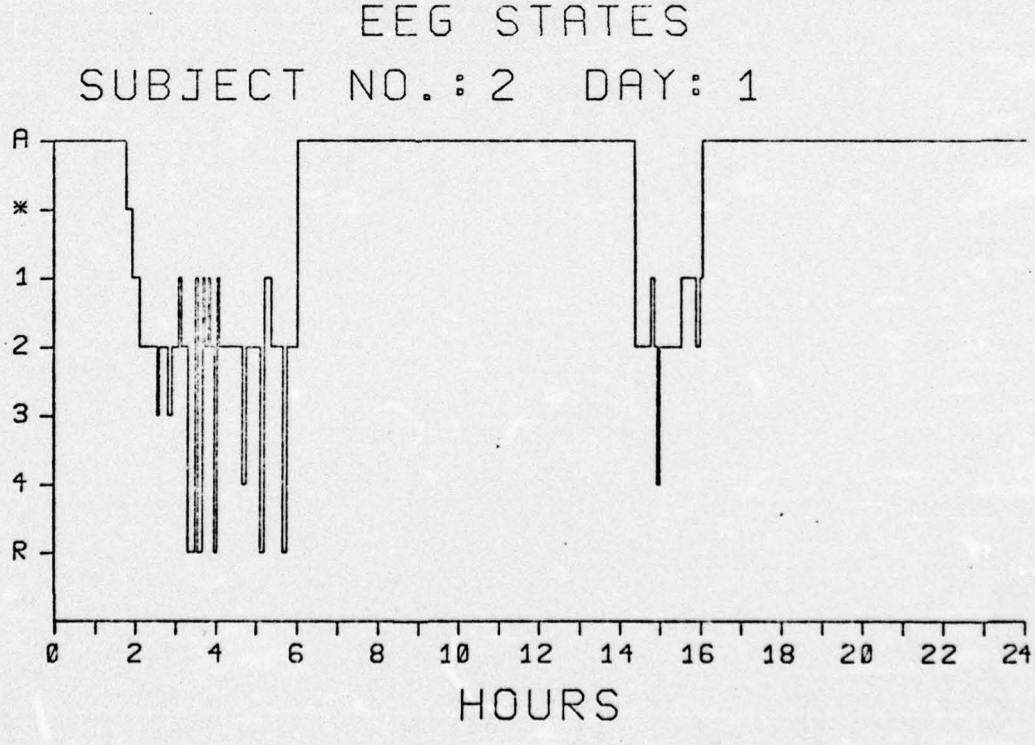
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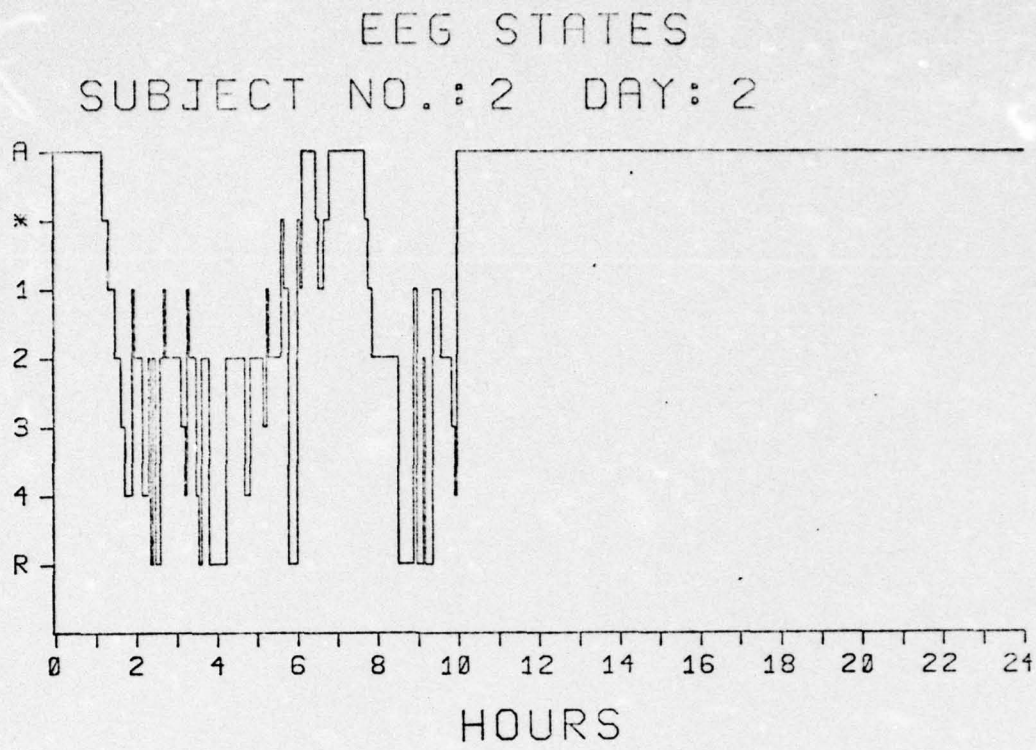
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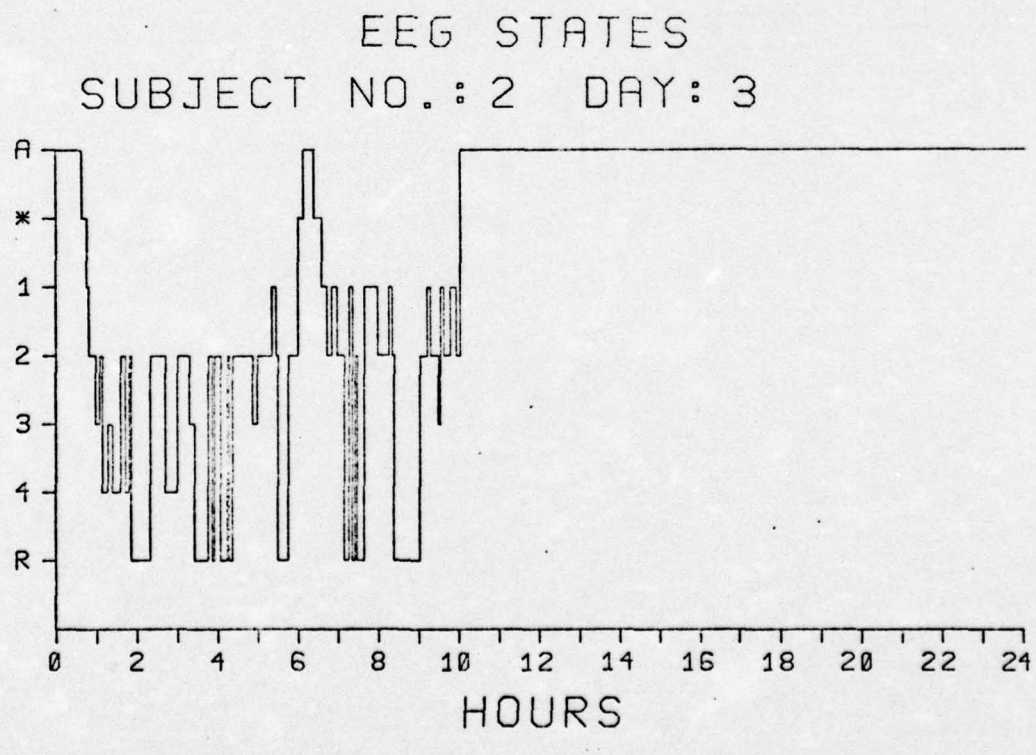
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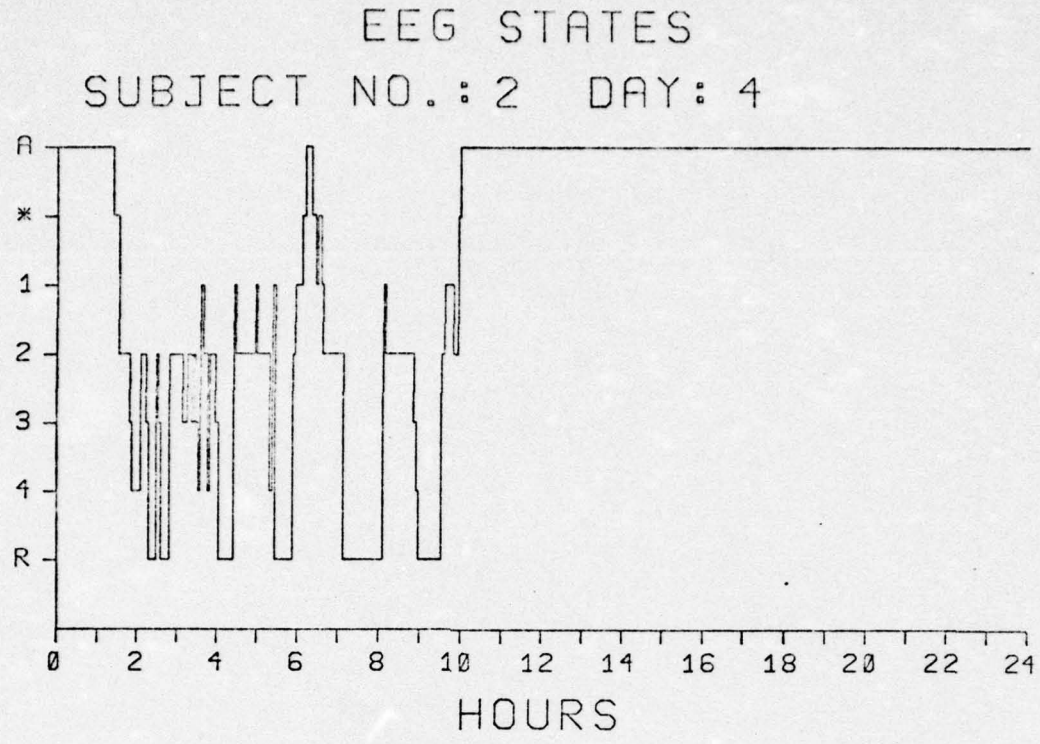
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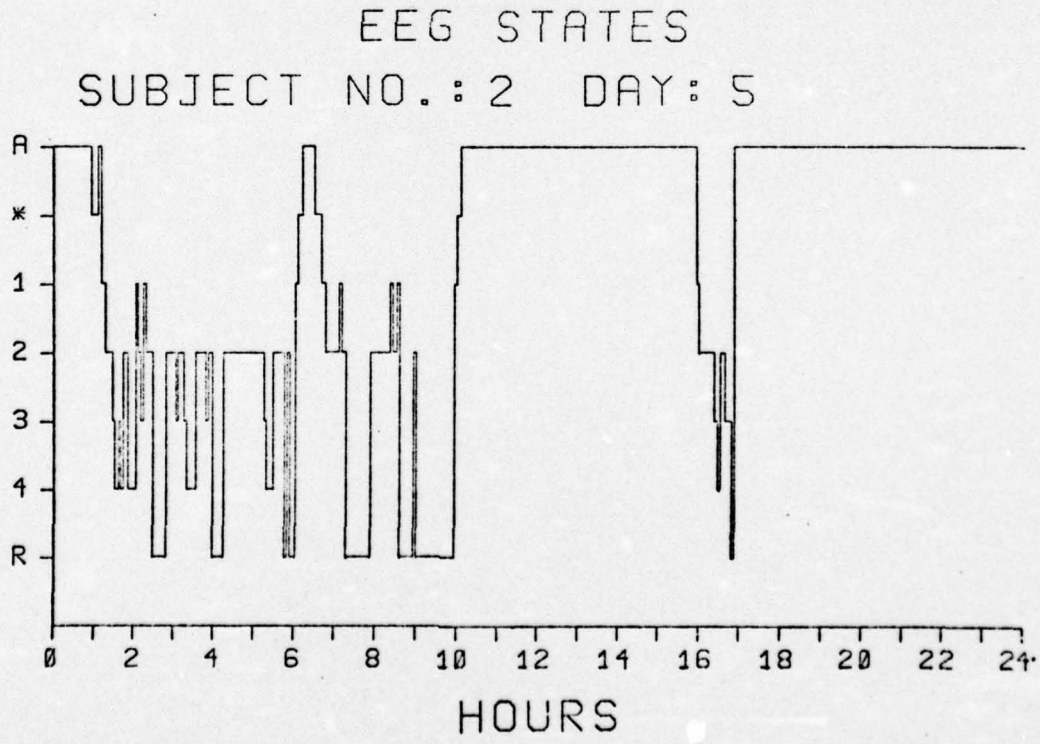
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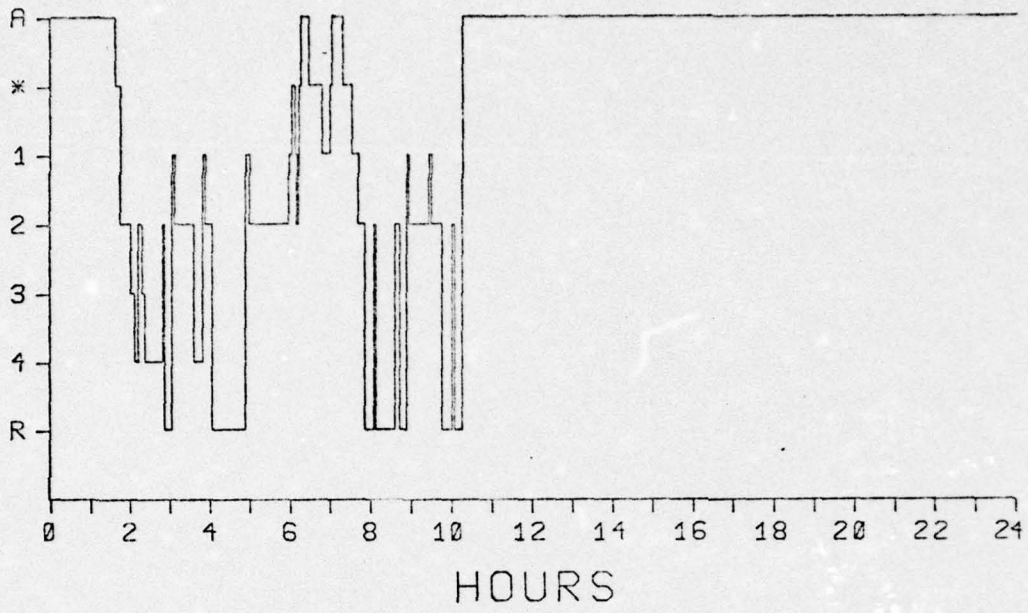

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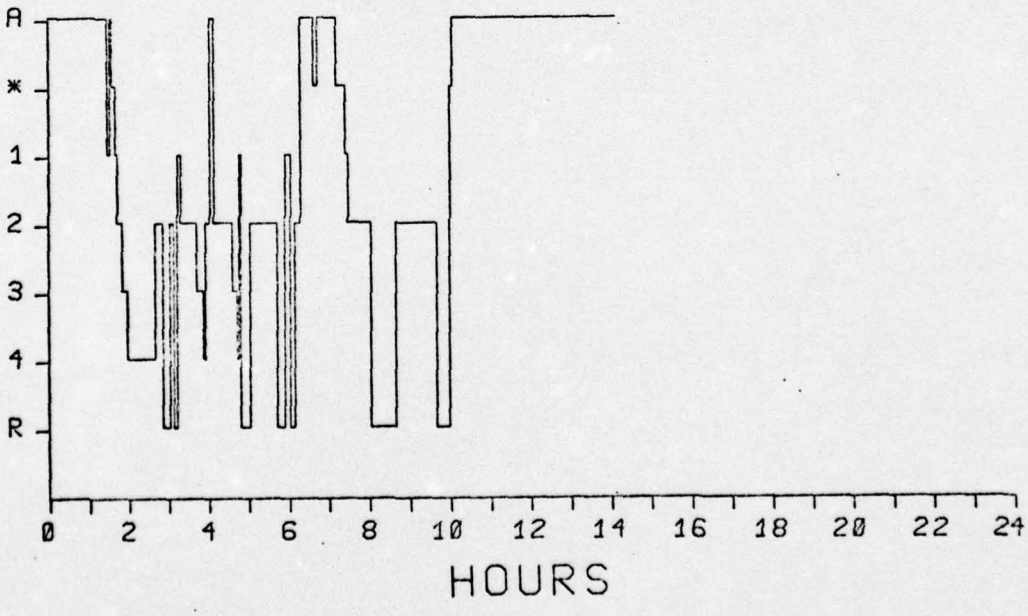

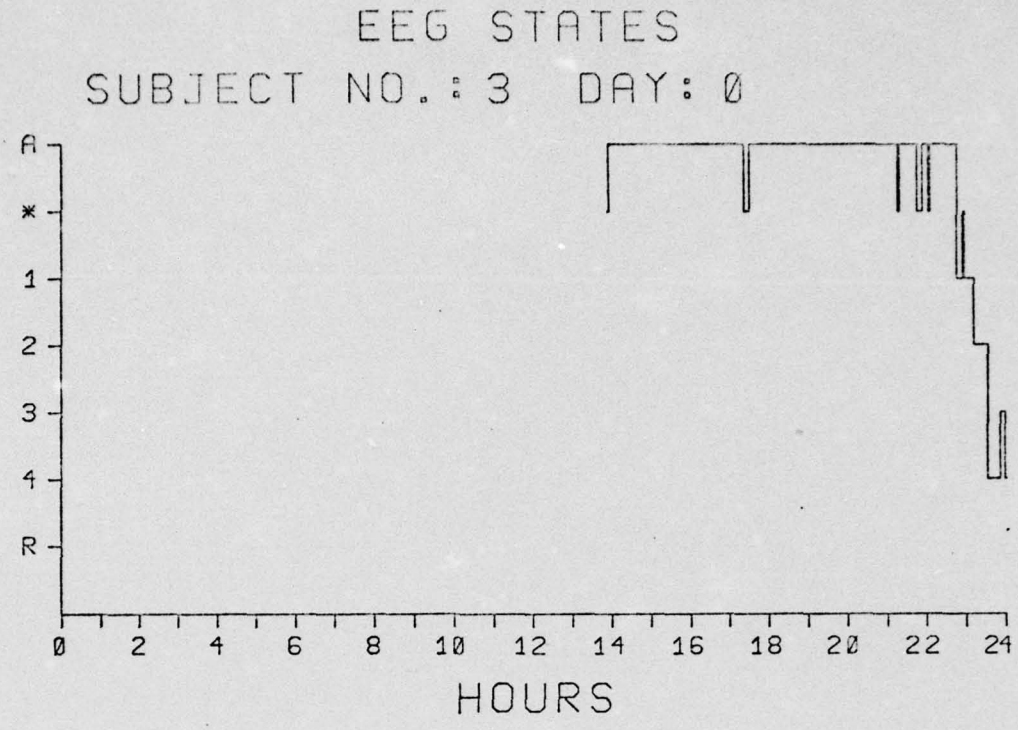
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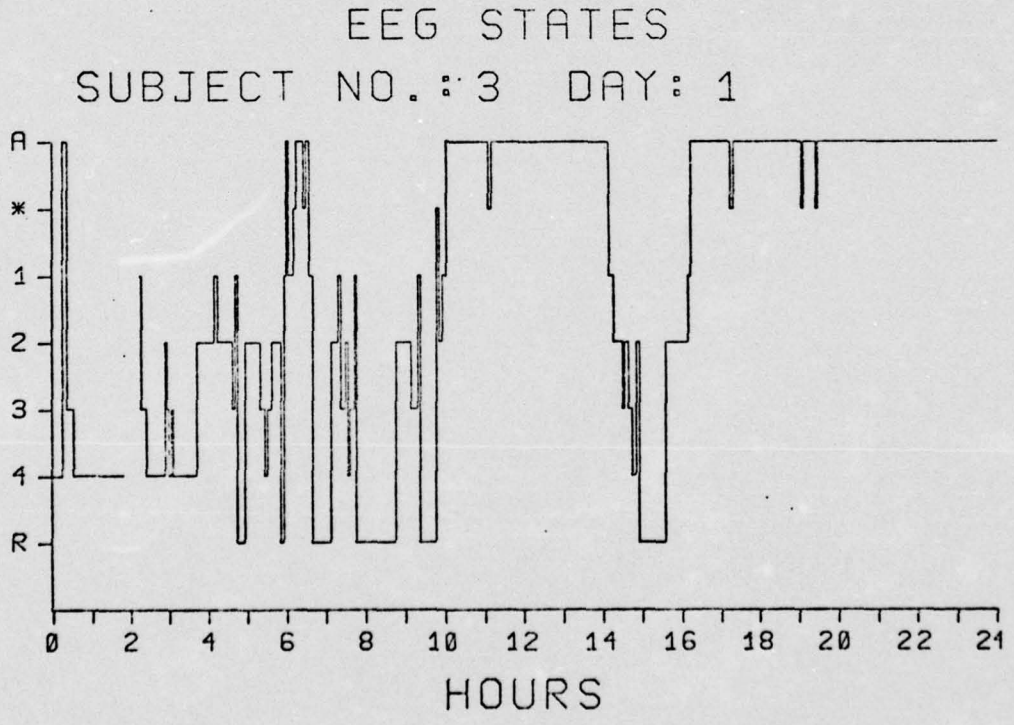
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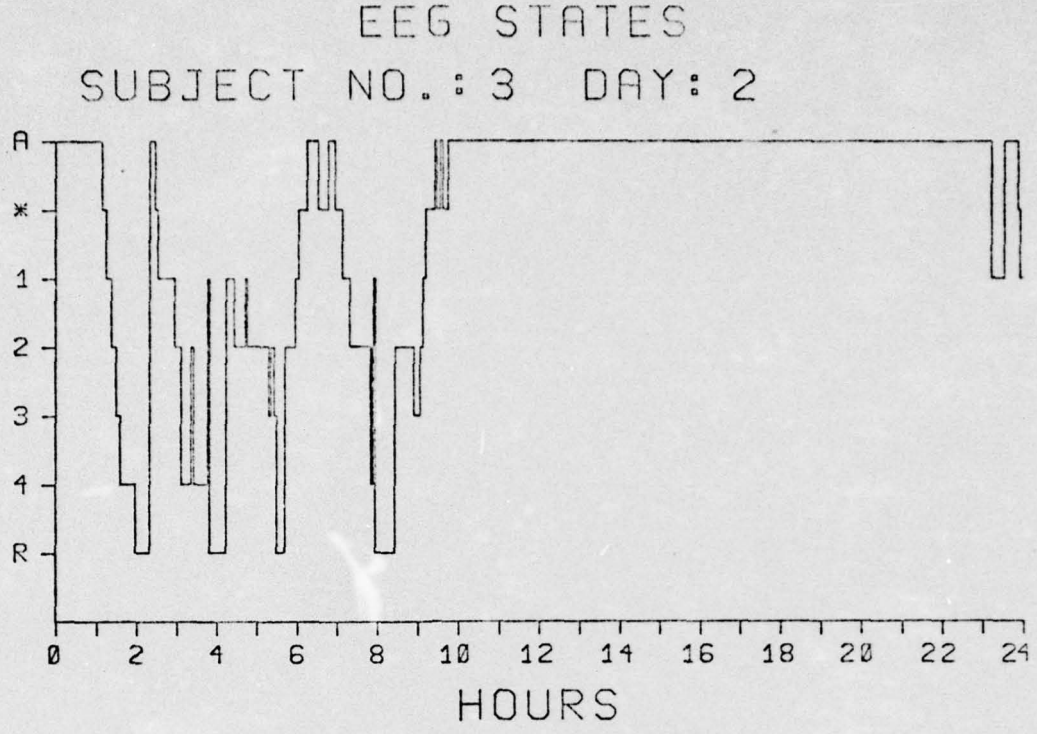
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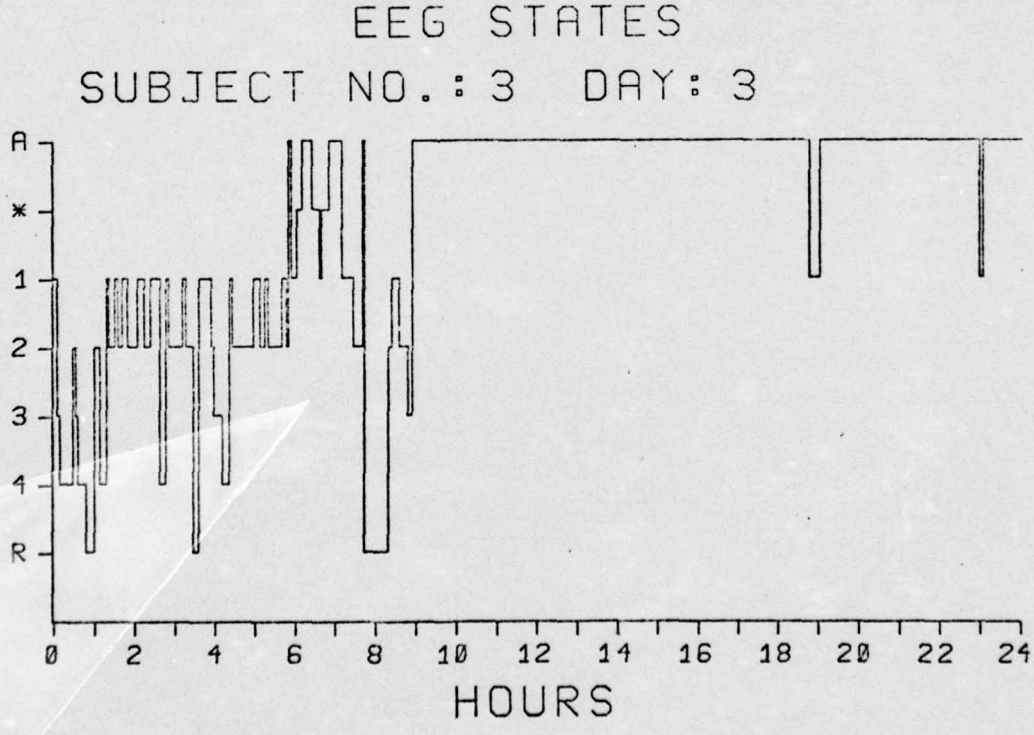
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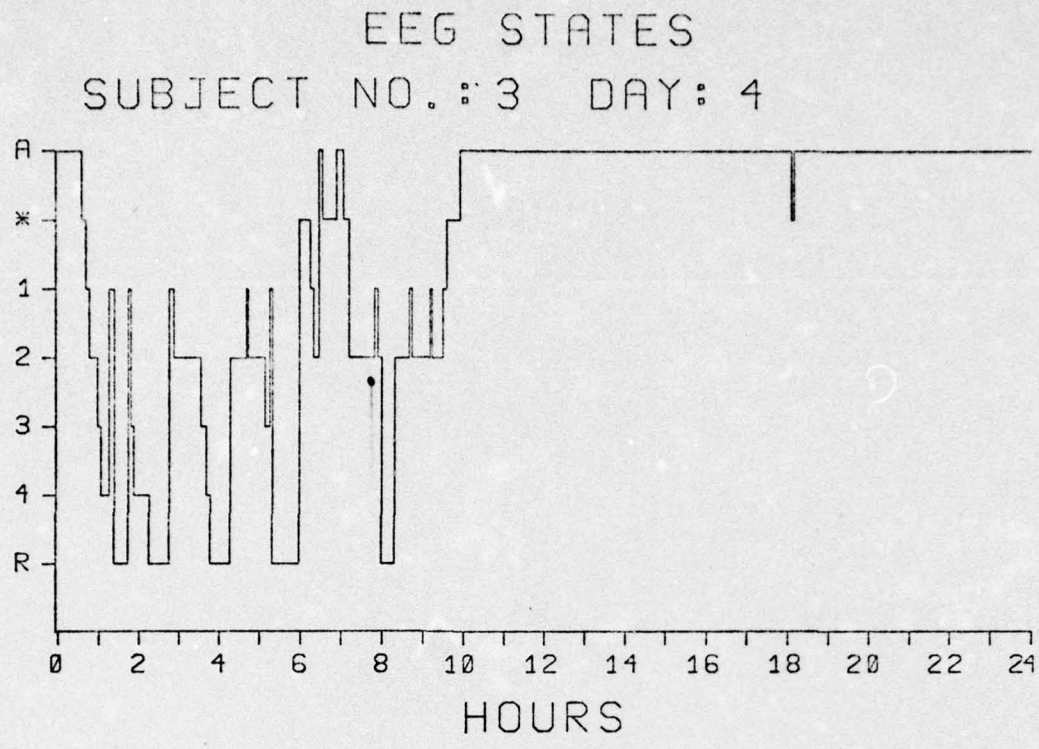
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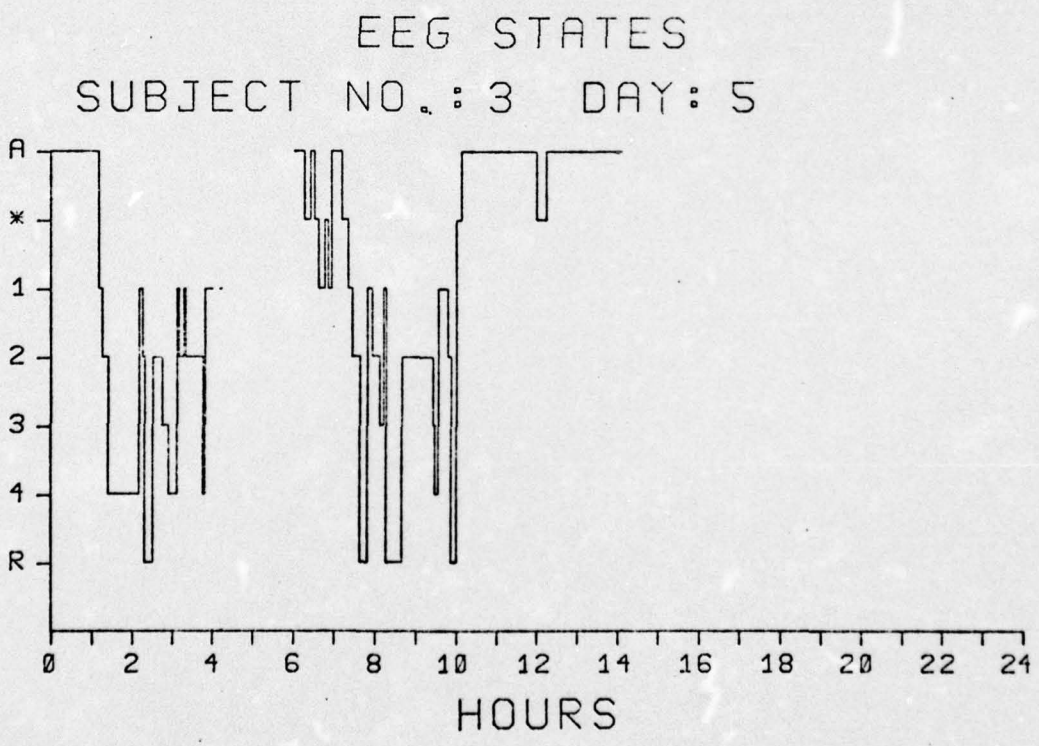
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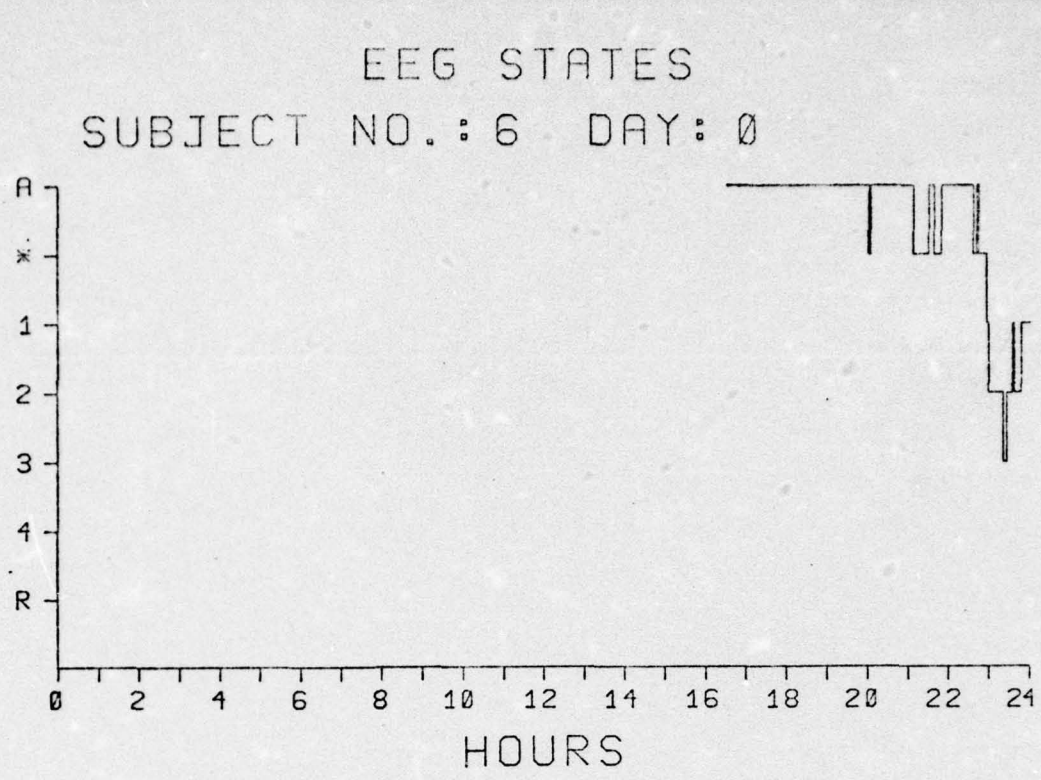
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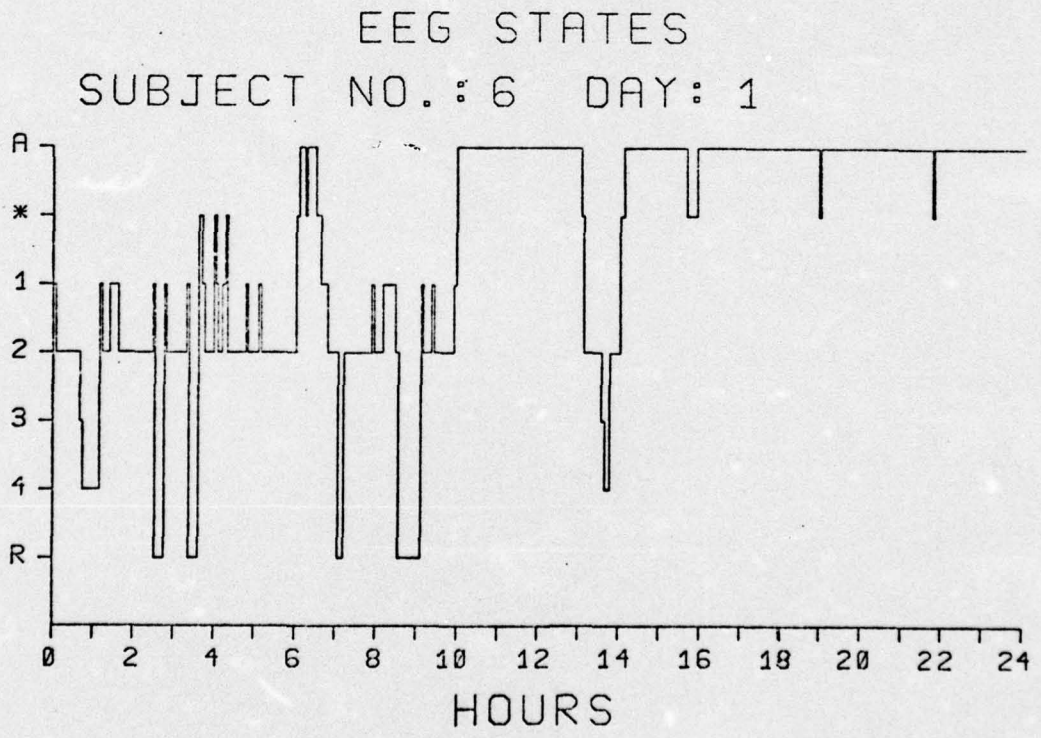
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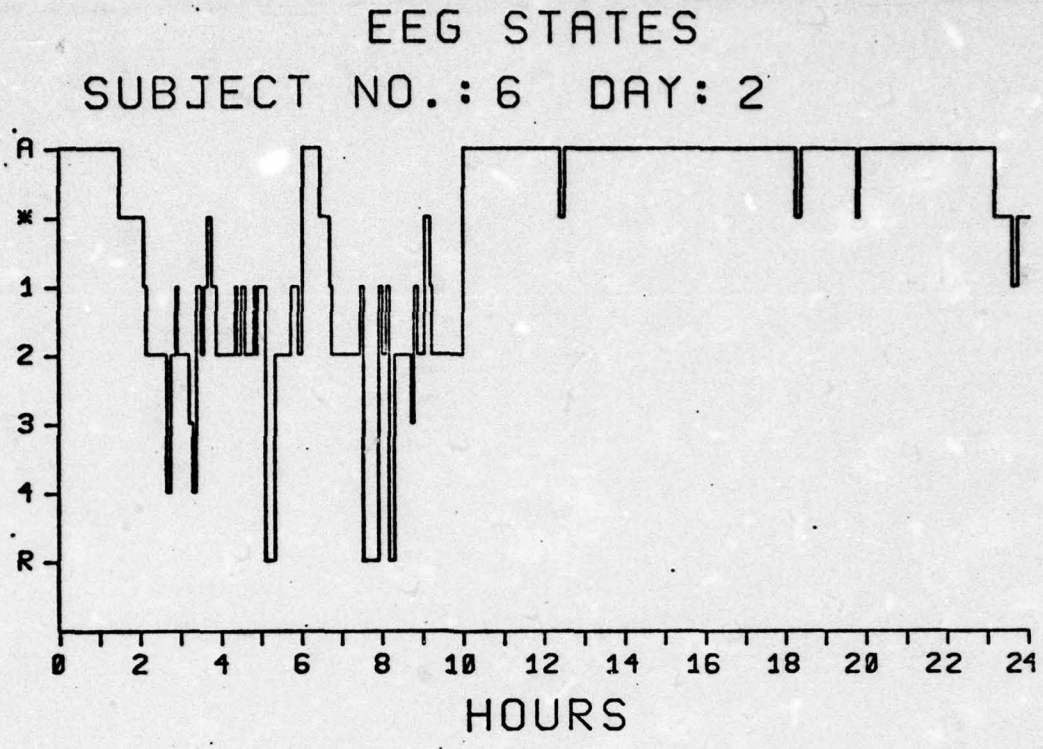
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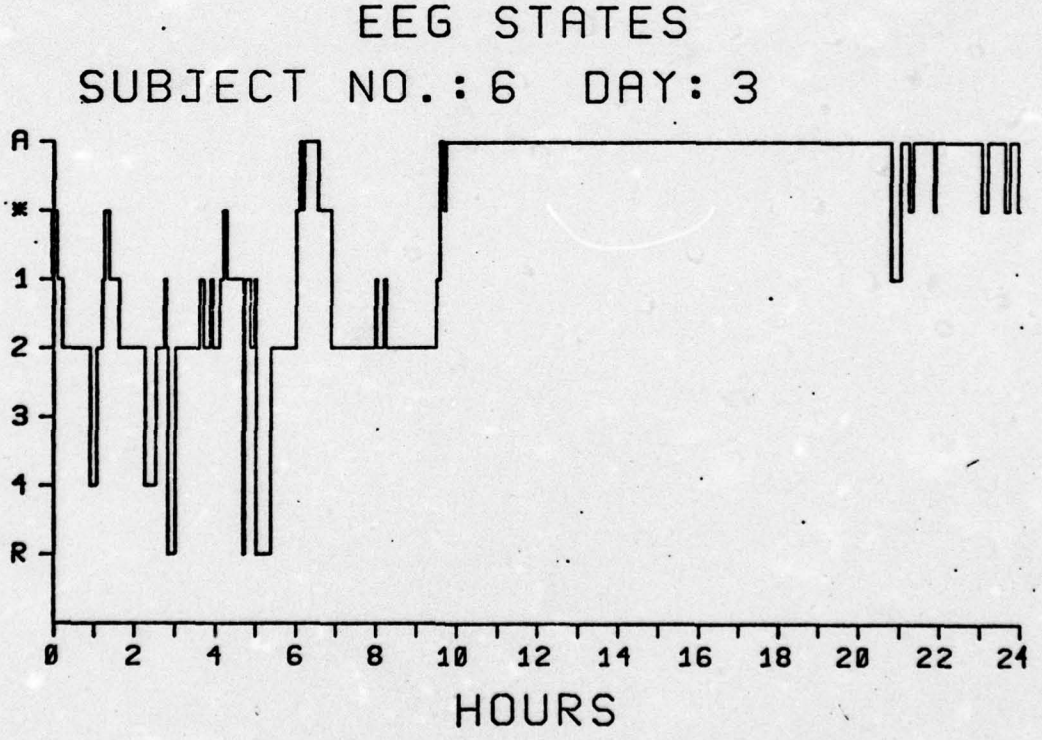
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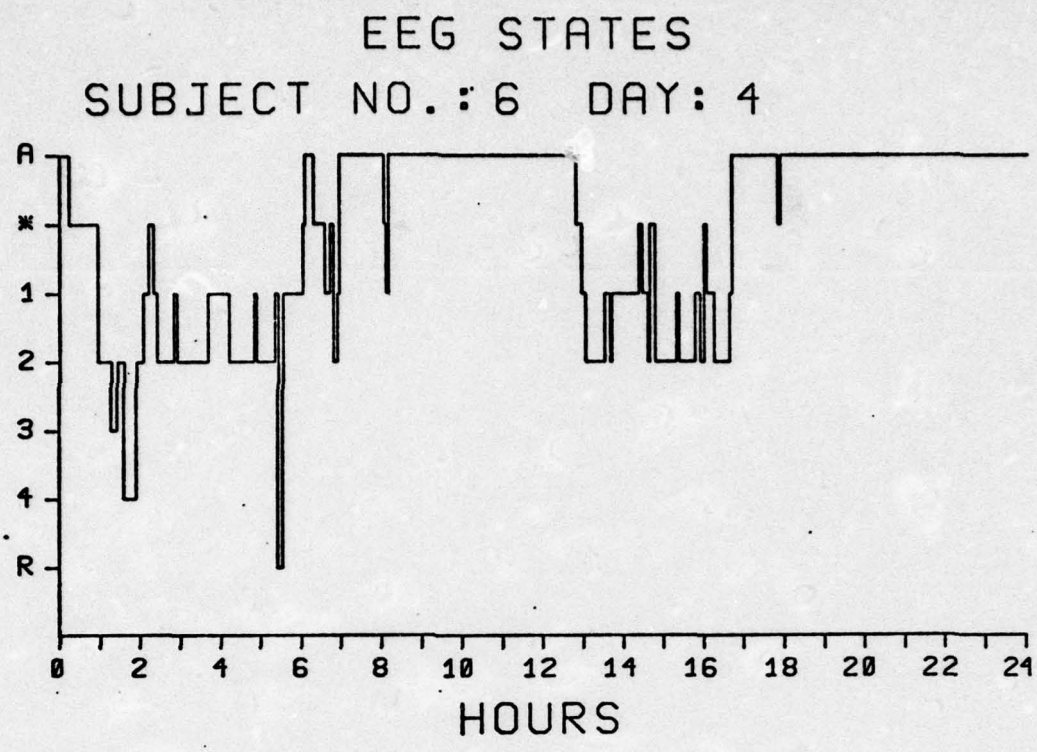
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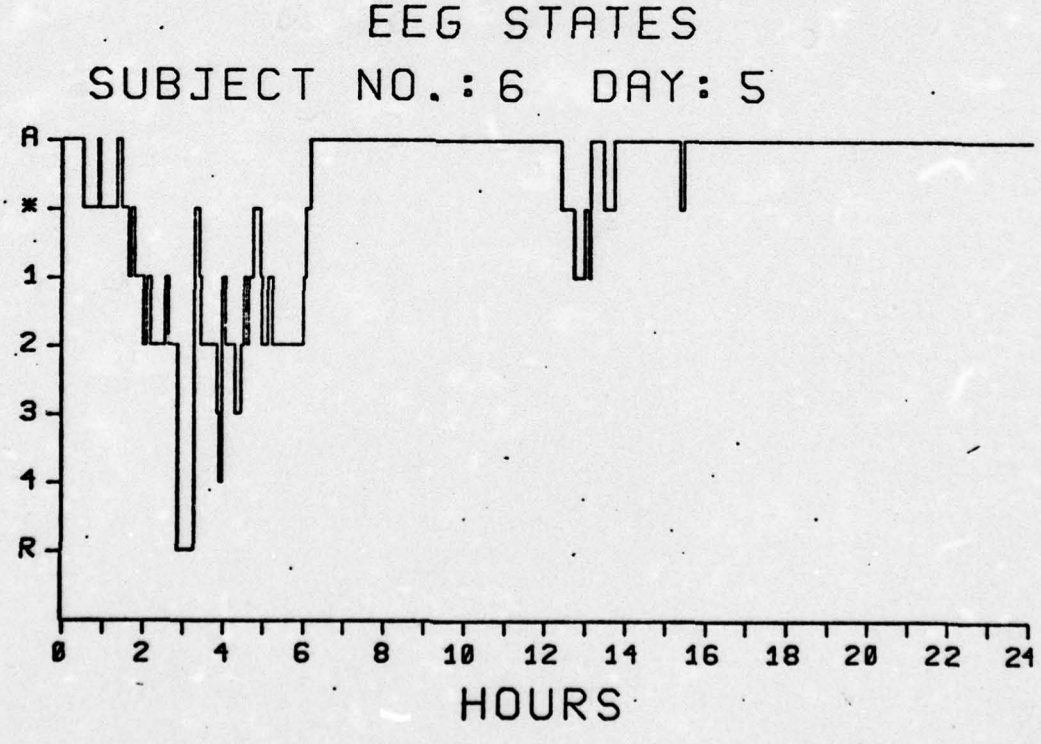
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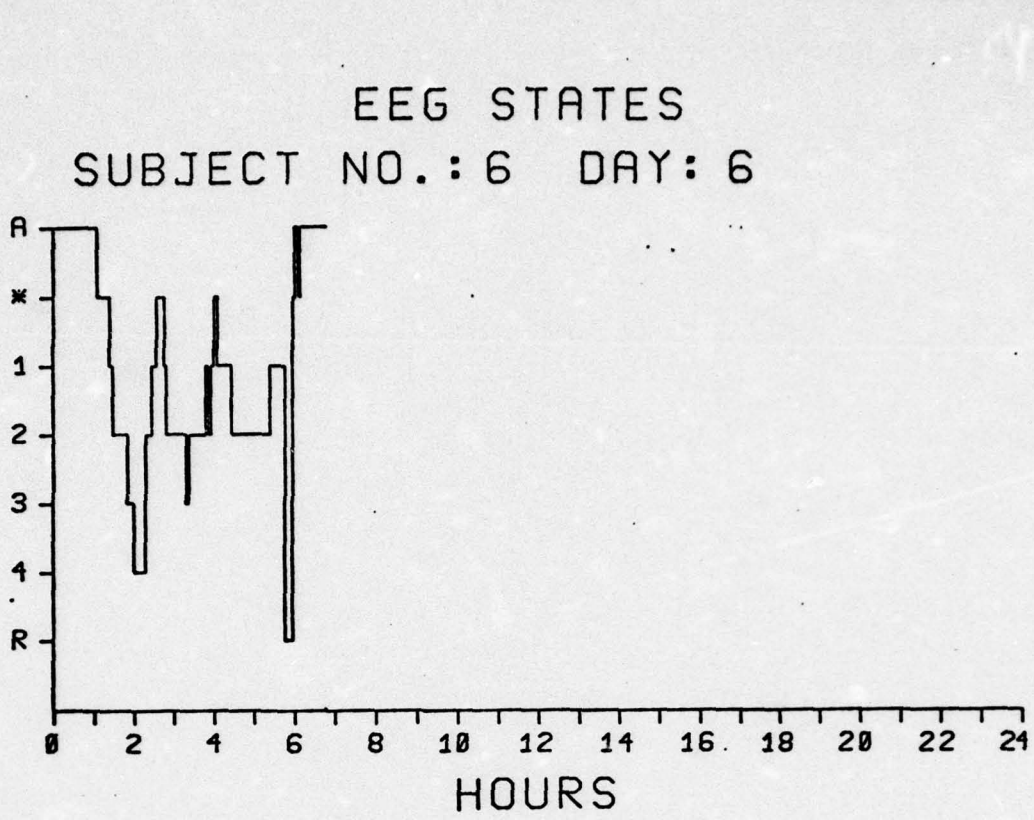
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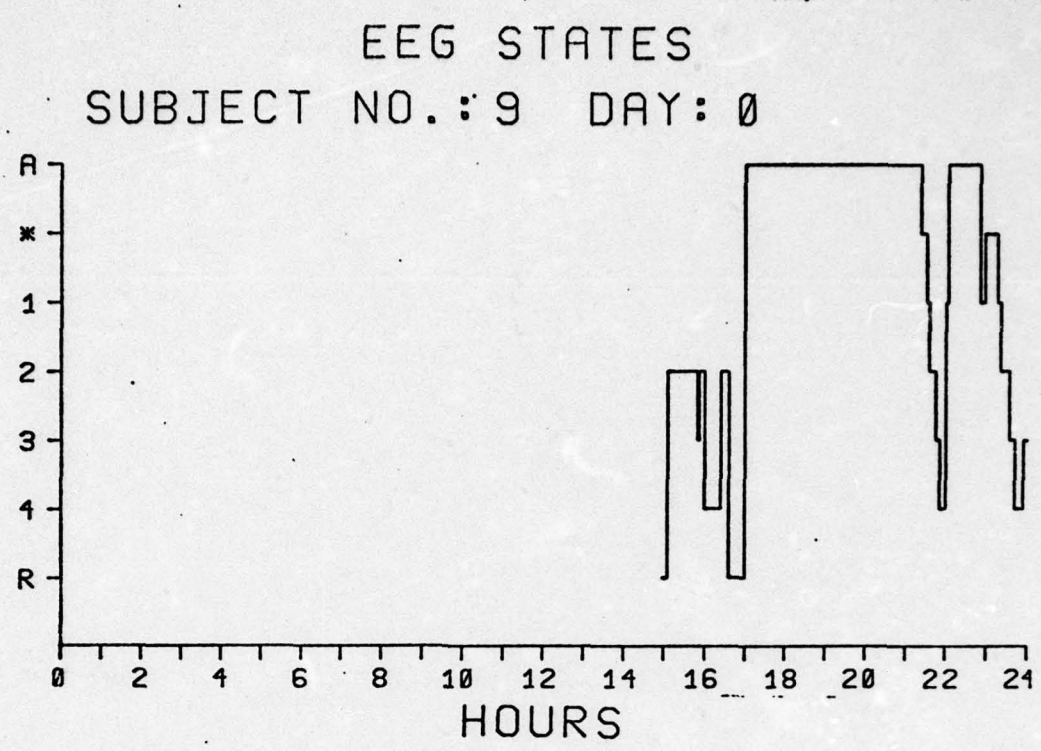
HOURS


EEG STATES
SUBJECT NO.: 9 DAY: 0
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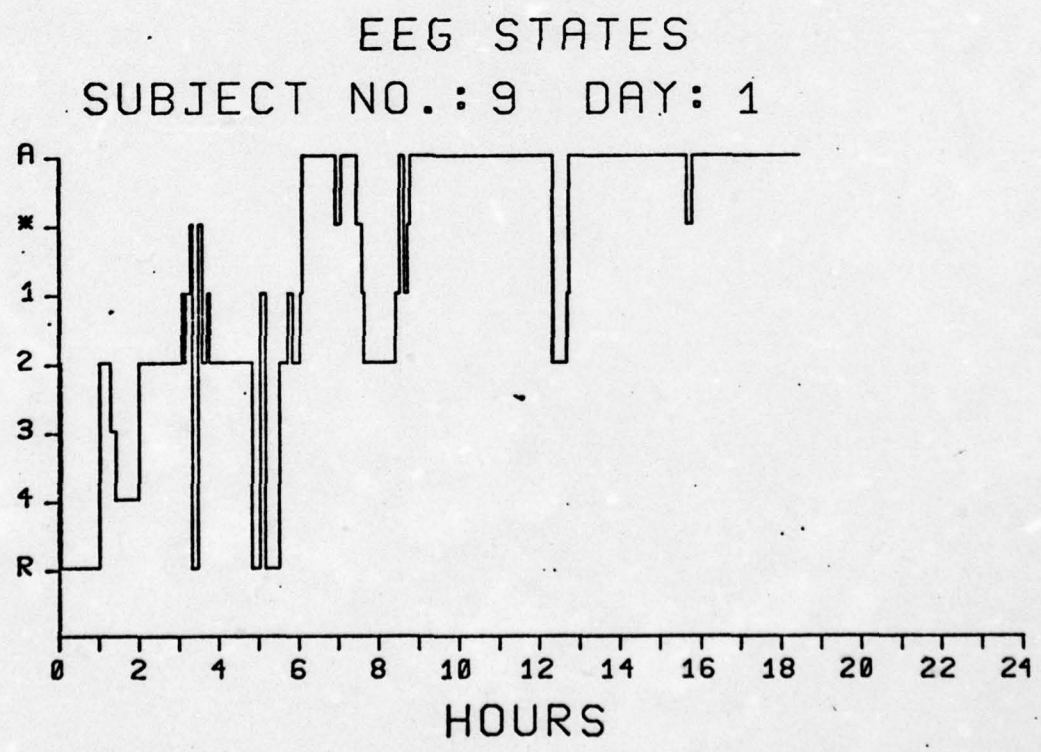
HOURS


EEG STATES
SUBJECT NO.: 9 DAY: 1
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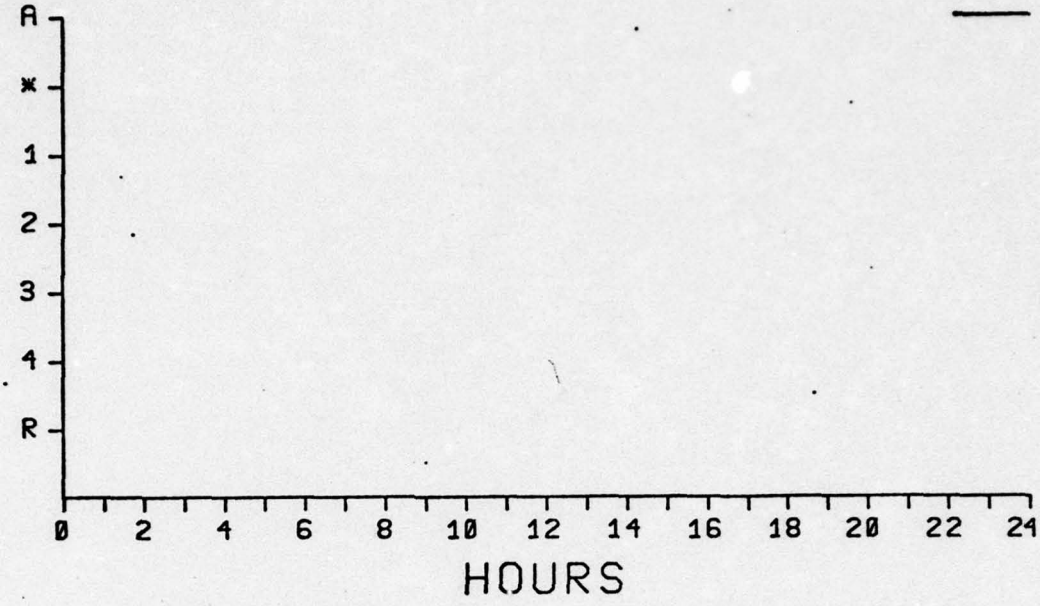
HOURS

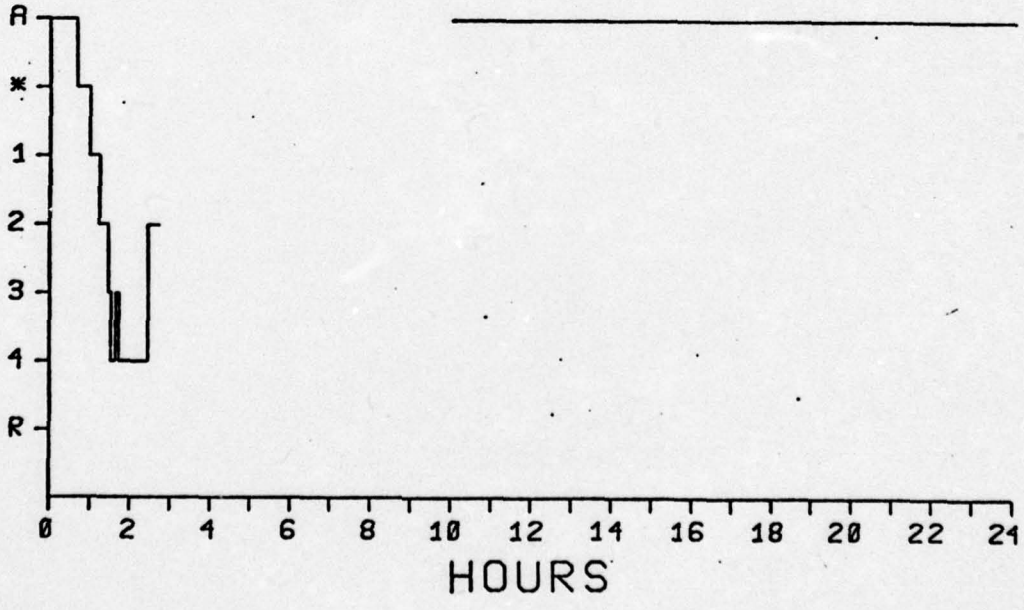
EEG STATES

SUBJECT NO.: 11 DAY: 0



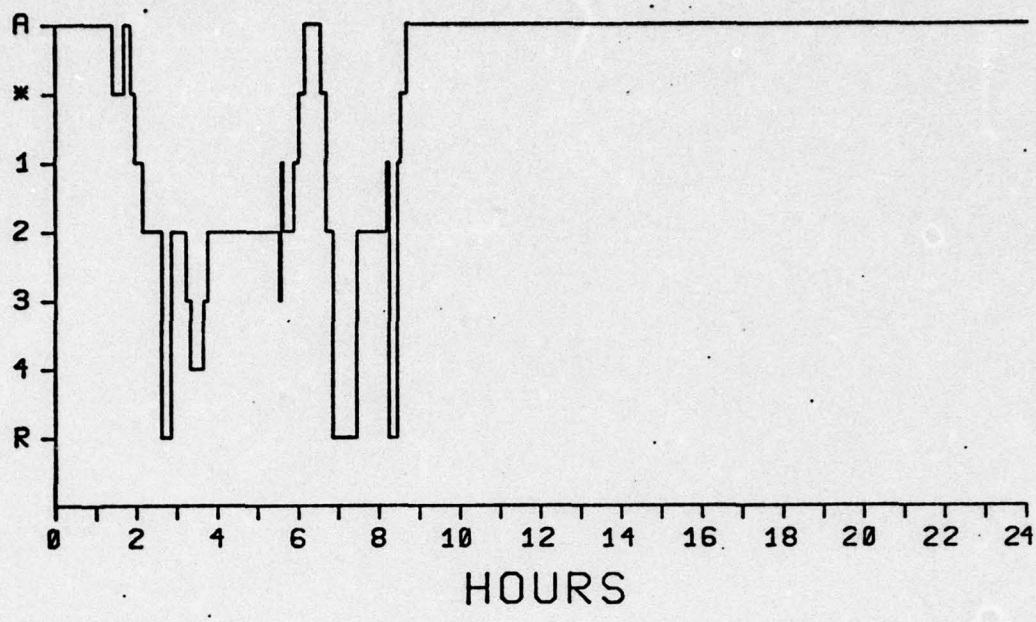
EEG STATES

SUBJECT NO.: 11 DAY: 1



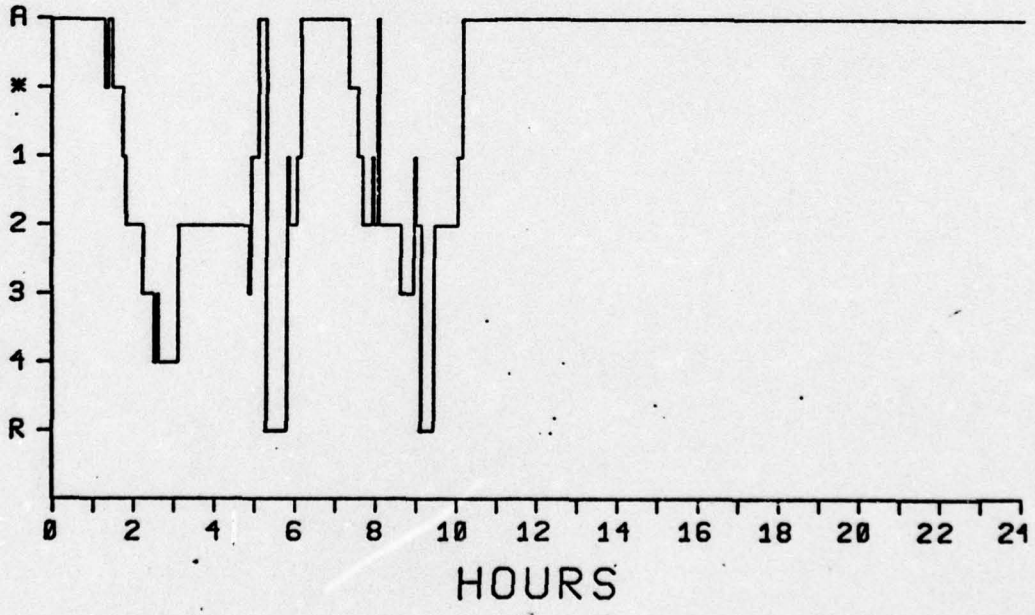
EEG STATES

SUBJECT NO.: 11 DAY: 2



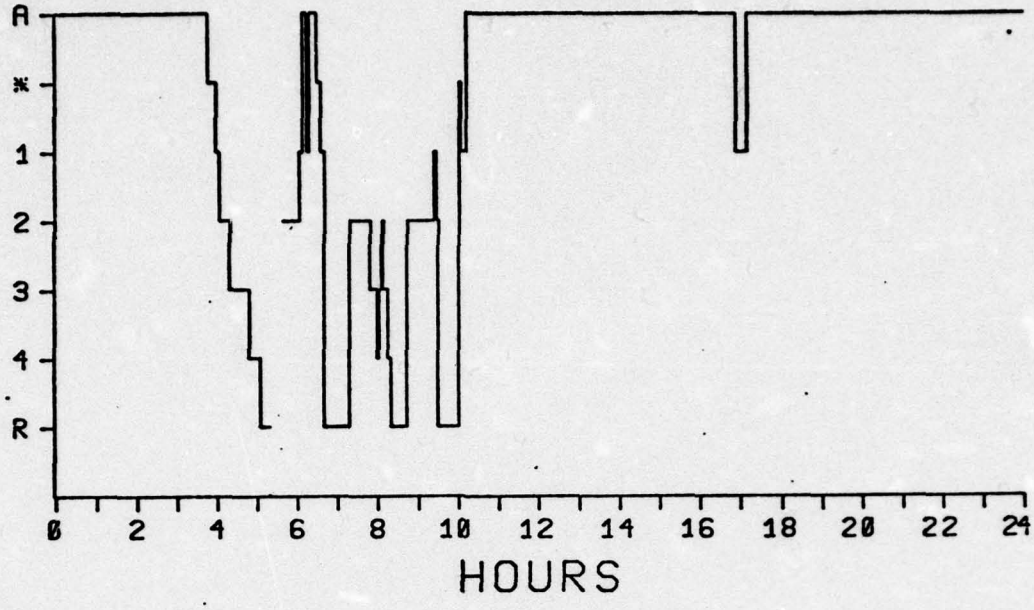
EEG STATES

SUBJECT NO.: 11 DAY: 3



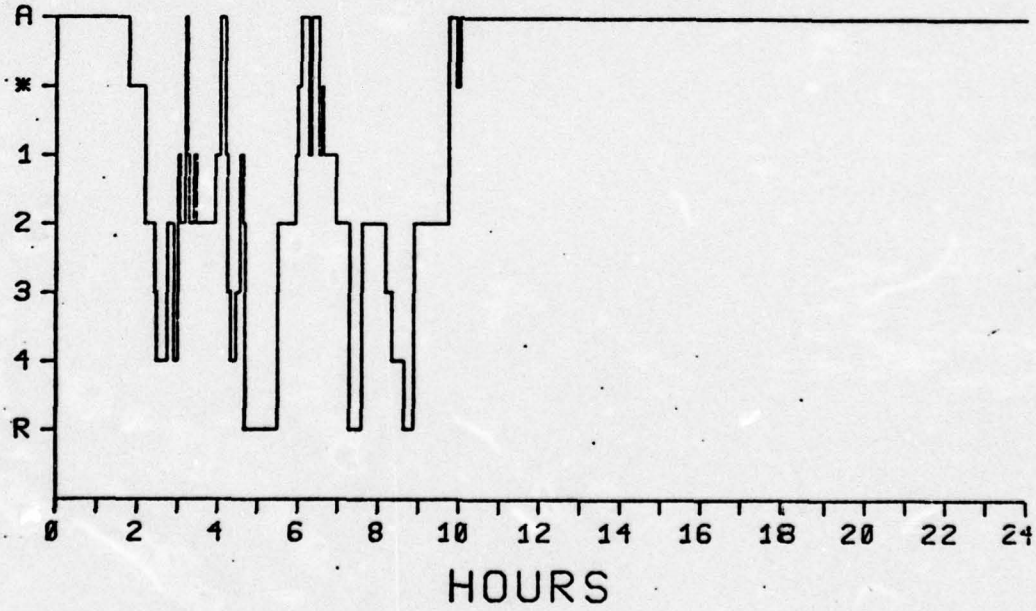
EEG STATES

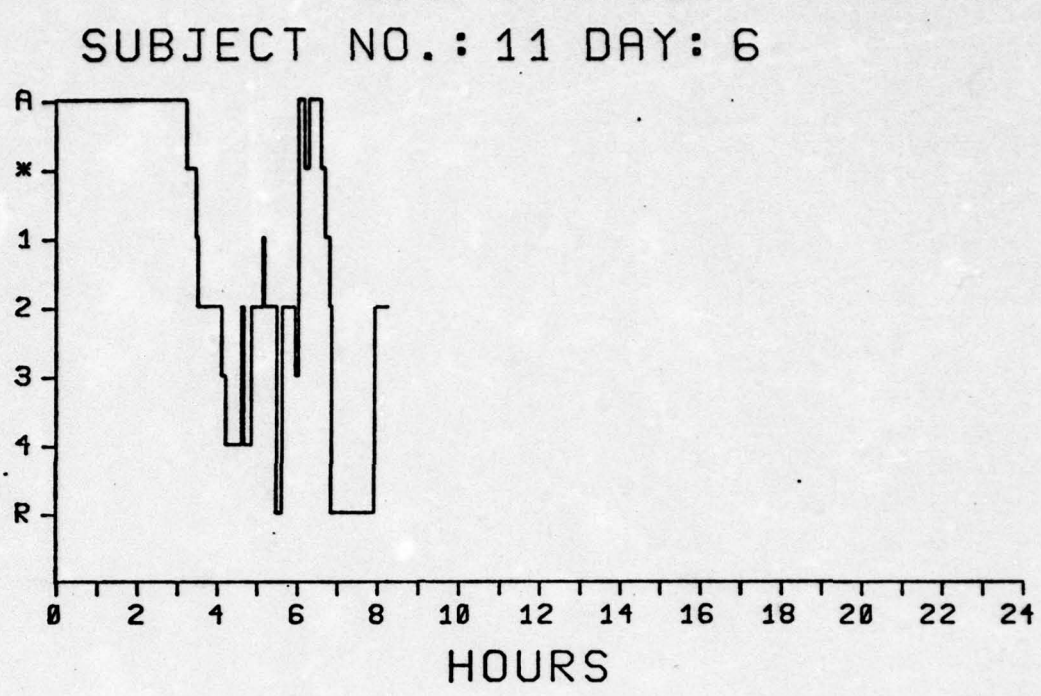
SUBJECT NO.: 11 DAY: 4



EEG STATES

SUBJECT NO.: 11 DAY: 5




EEG STATES
SUBJECT NO.: 11 DAY: 6
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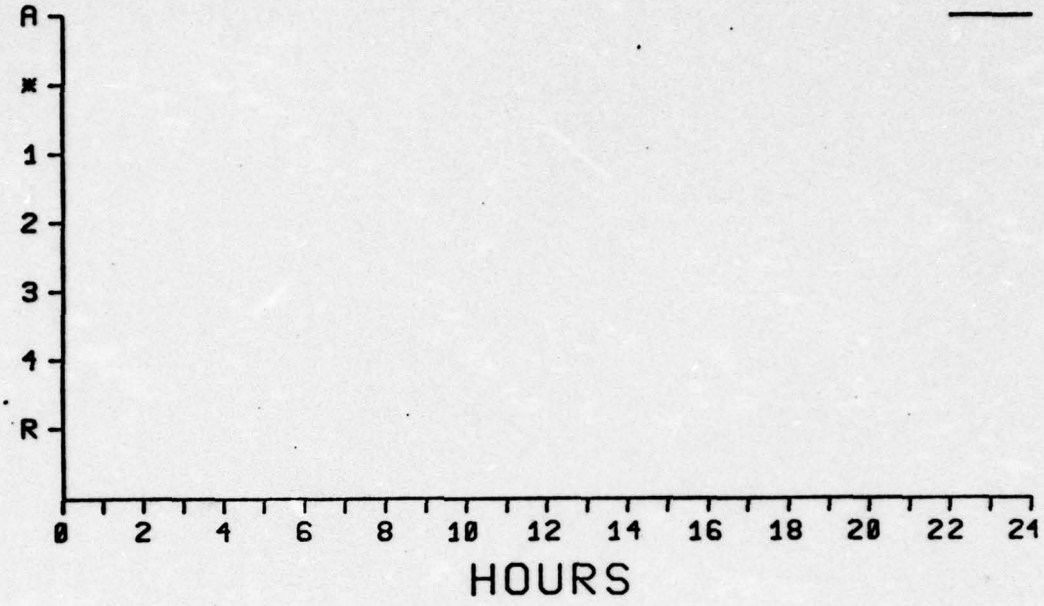
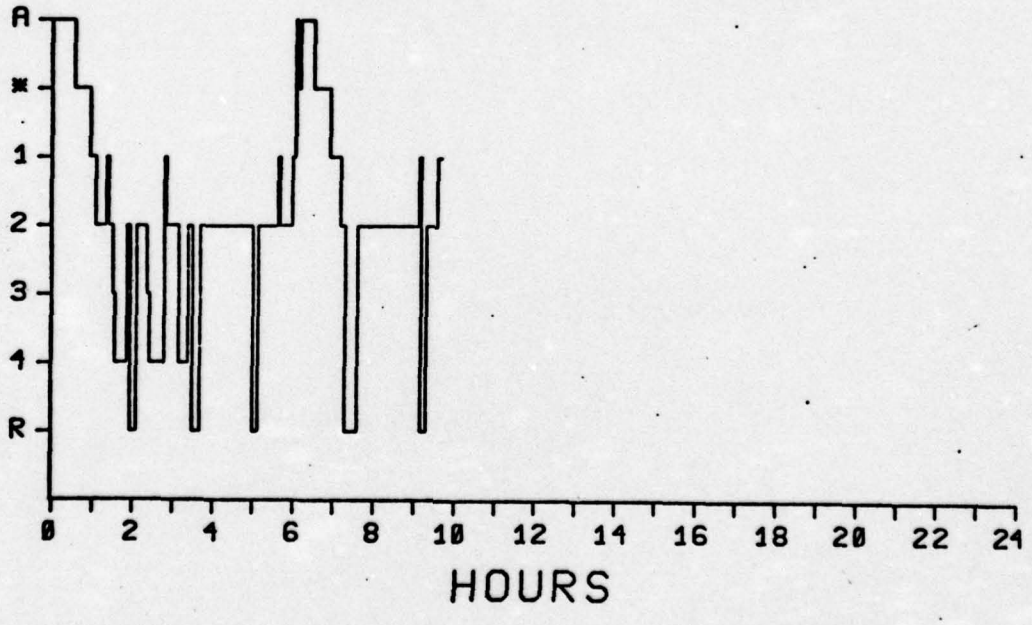
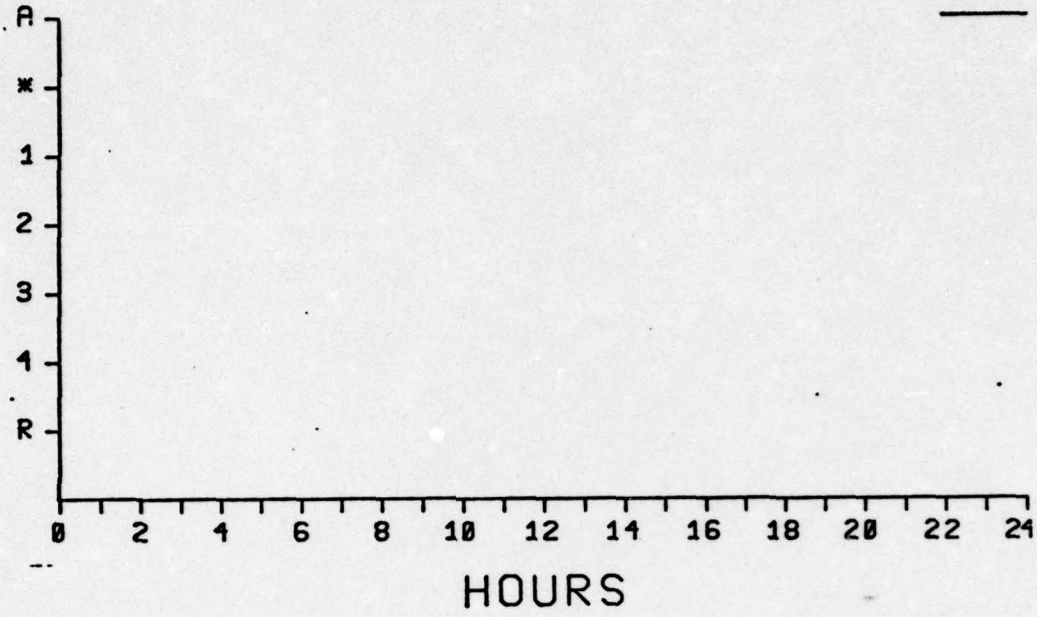
EEG STATES
SUBJECT NO.: 11 DAY: 0F



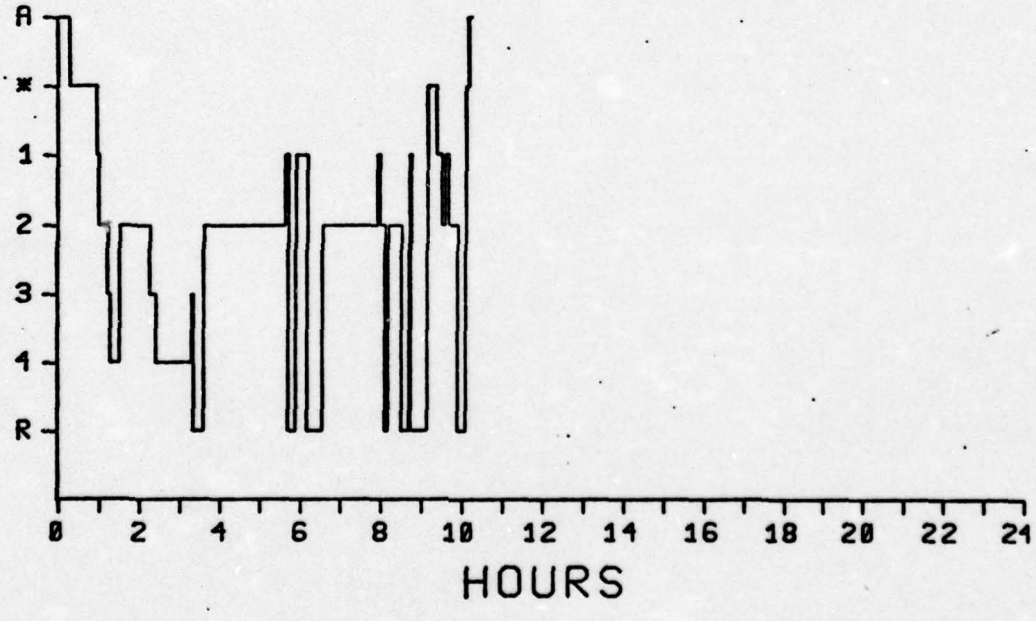
EEG STATES
SUBJECT NO.: 11 DAY: 1F



EEG STATES
SUBJECT NO.: 11 DAY: 2F

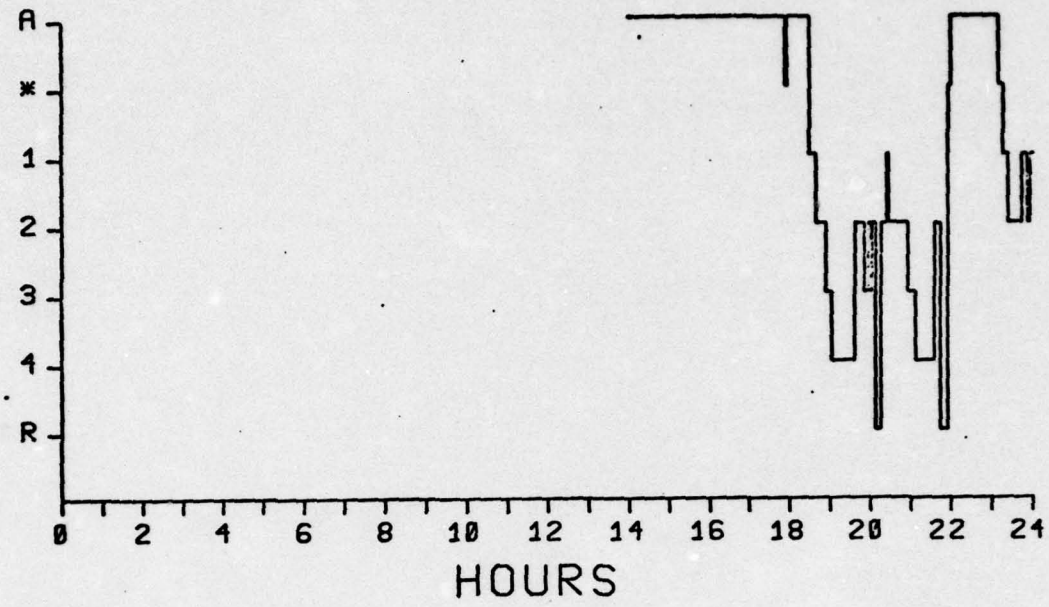


EEG STATES
SUBJECT NO.: 11 DAY: 3F



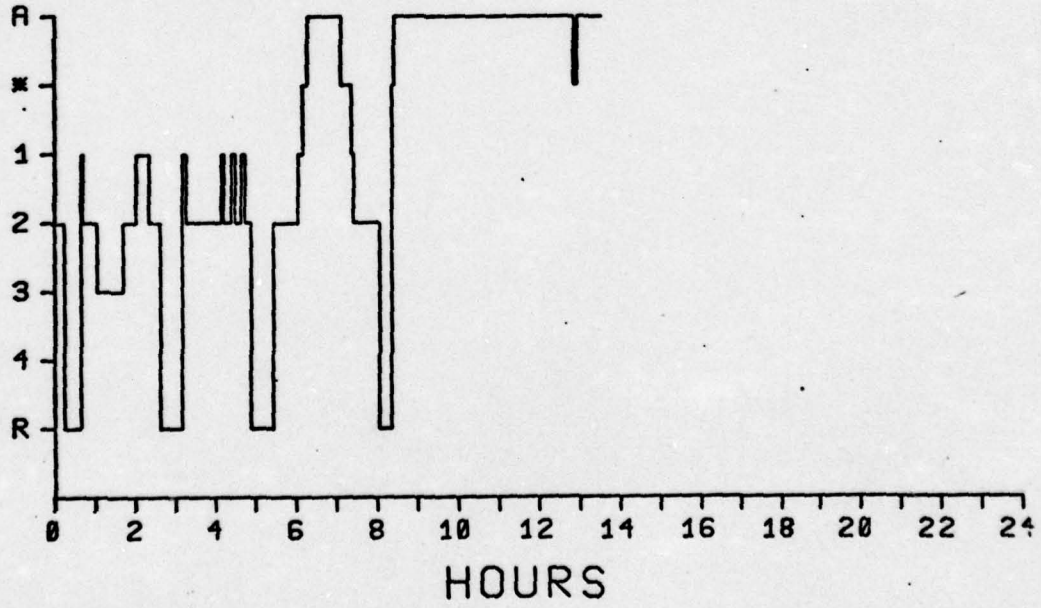
EEG STATES

SUBJECT NO.: 16 DAY: 0



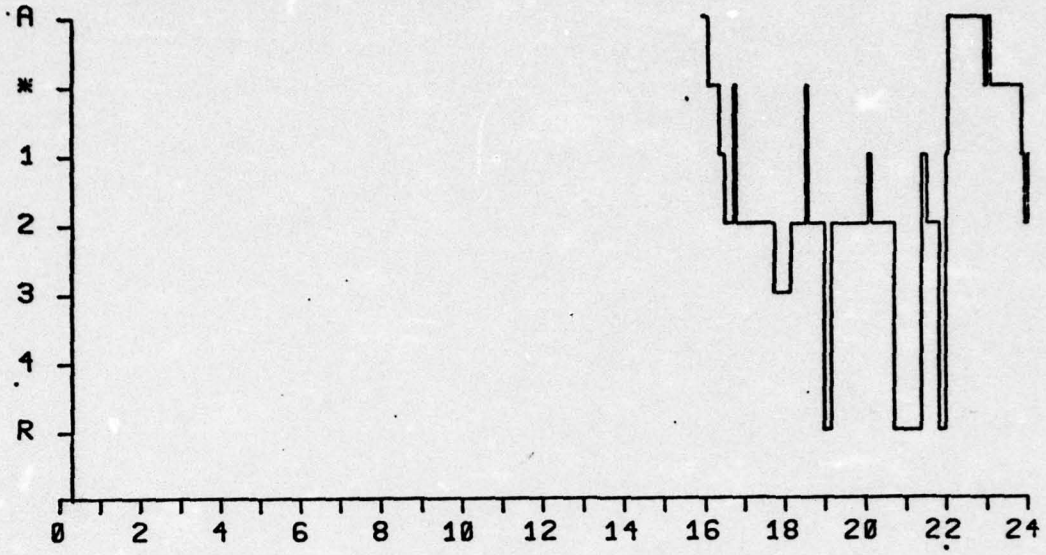
EEG STATES

SUBJECT NO.: 16 DAY: 1



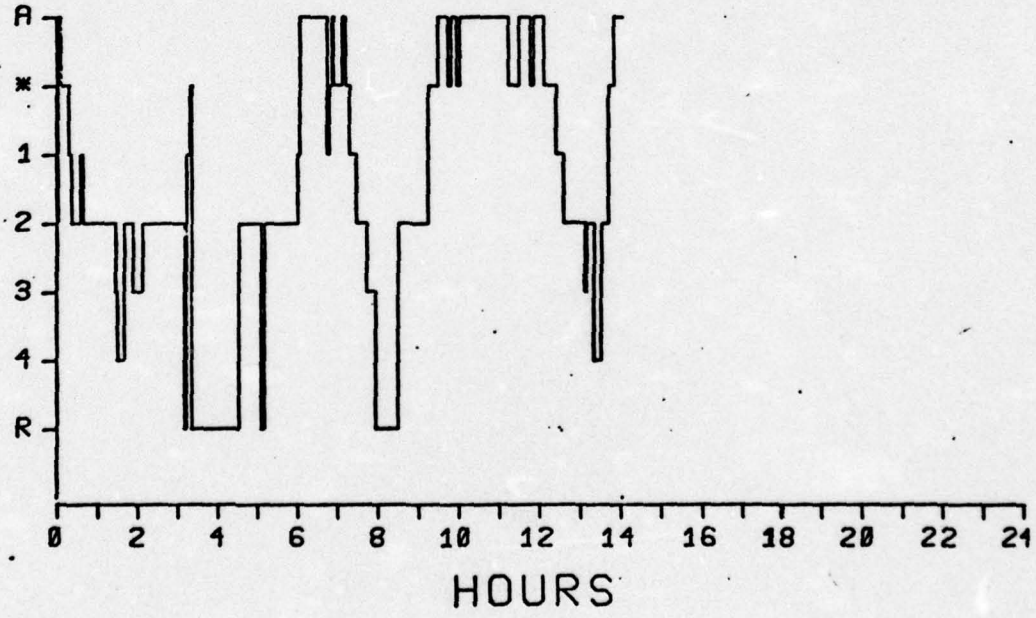
EEG STATES

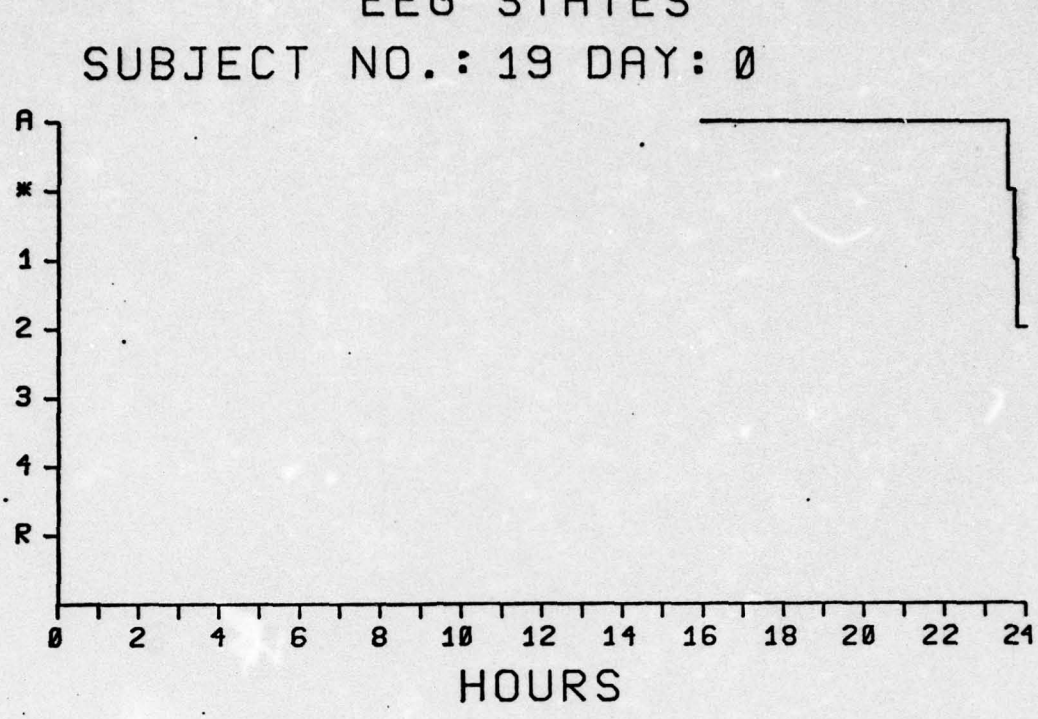
SUBJECT NO.: 18 DAY: 0



EEG STATES

SUBJECT NO.: 18 DAY: 1




EEG STATES
SUBJECT NO.: 19 DAY: 0
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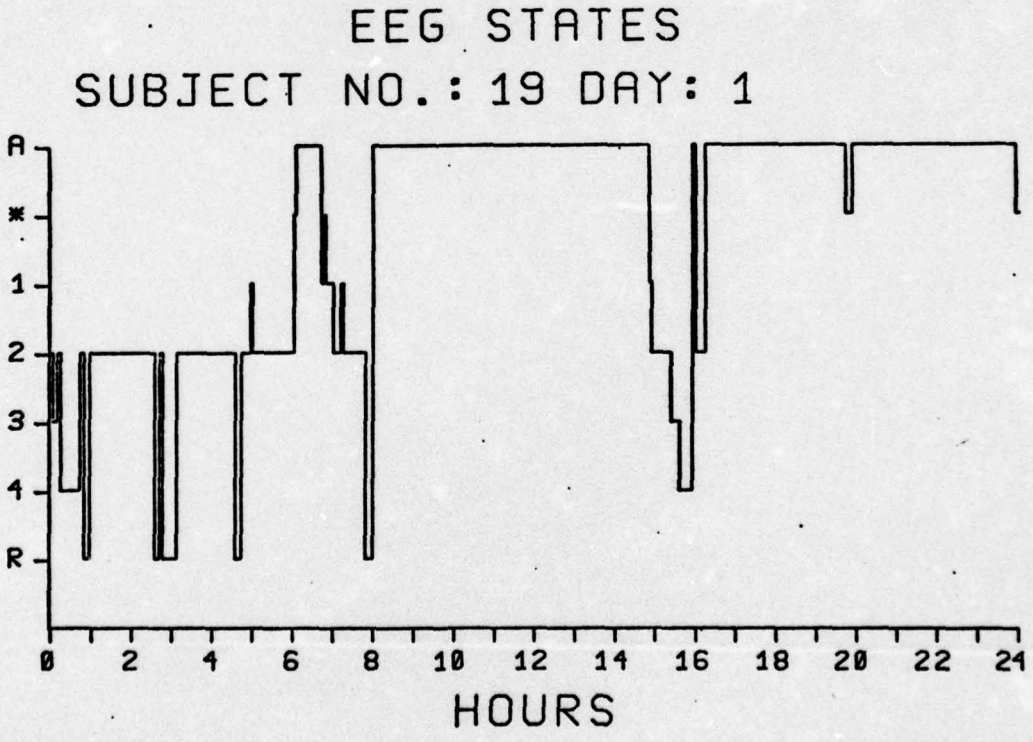
EEG STATES
SUBJECT NO.: 19 DAY: 1
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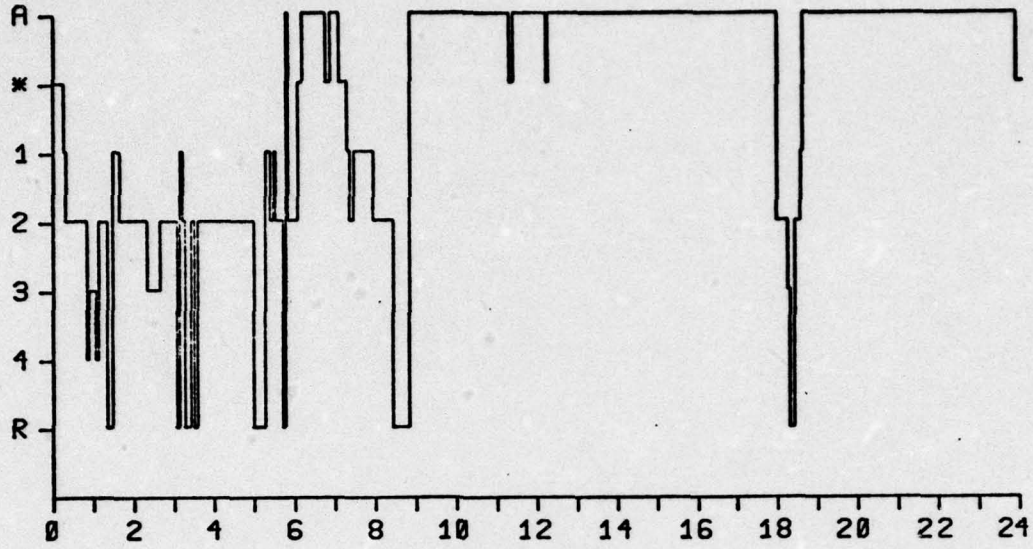
HOURS

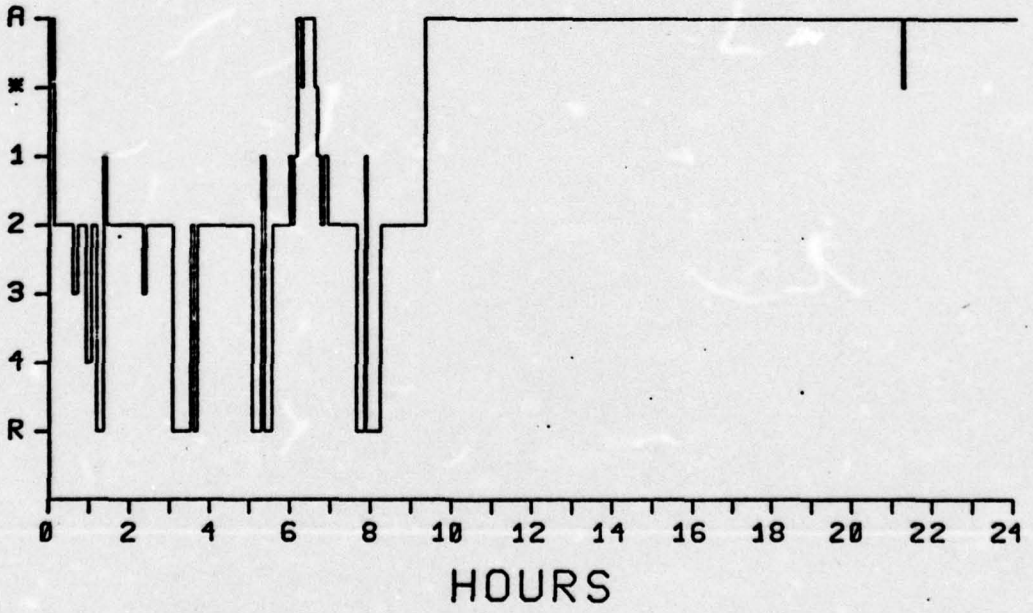
EEG STATES

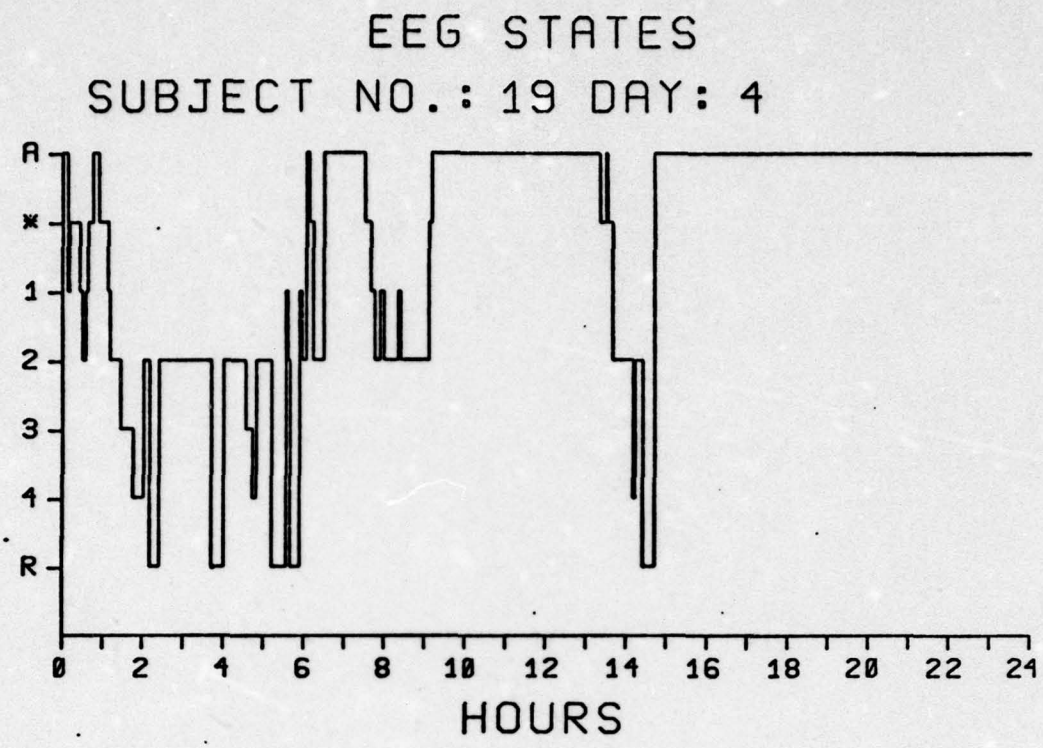
SUBJECT NO.: 19 DAY: 2



EEG STATES

SUBJECT NO.: 19 DAY: 3




EEG STATES
SUBJECT NO.: 19 DAY: 4
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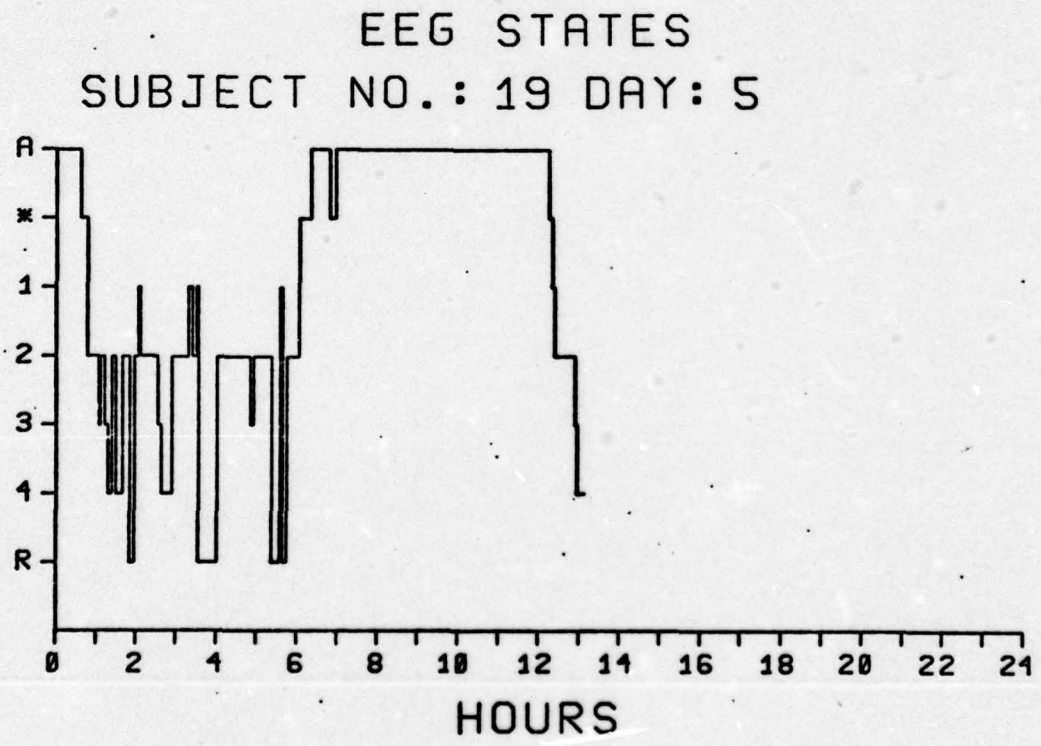
EEG STATES
SUBJECT NO.: 19 DAY: 5
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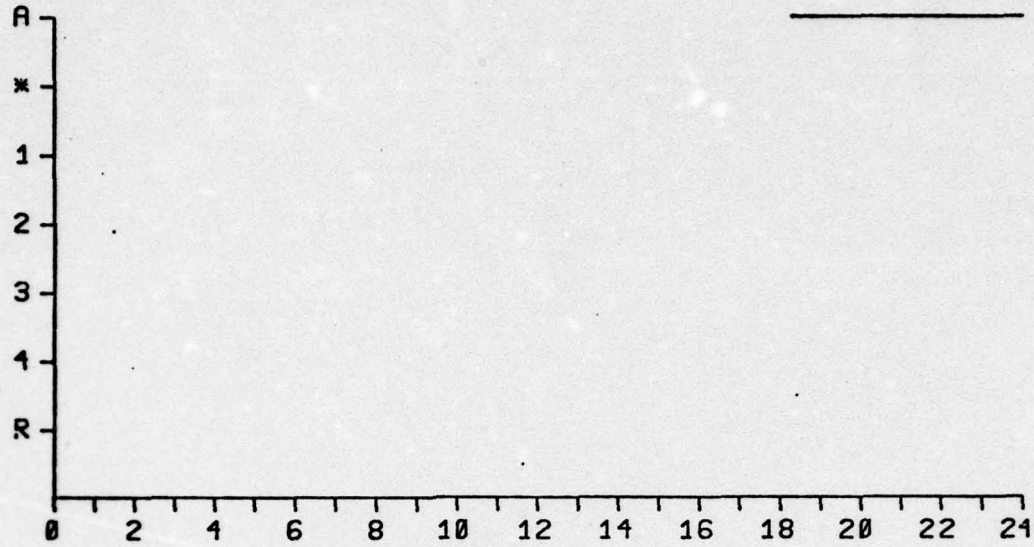
HOURS

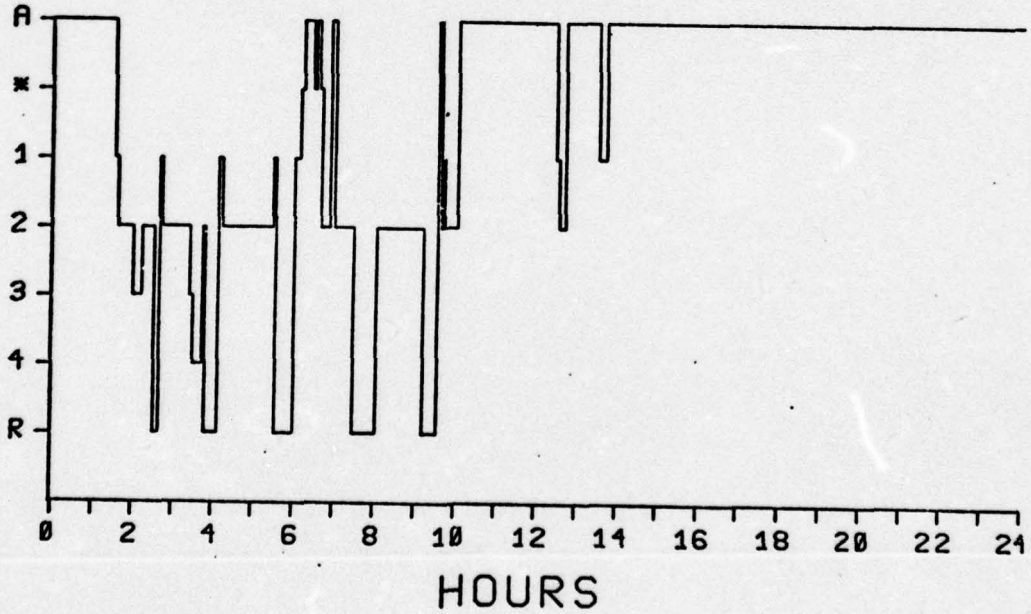
EEG STATES

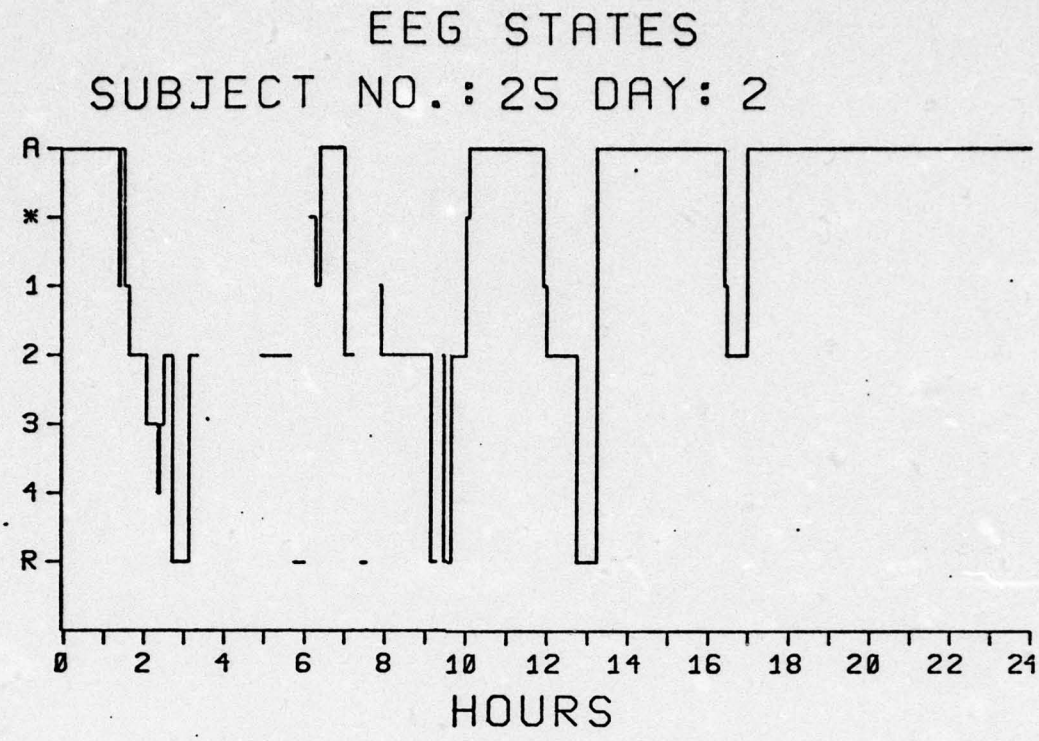
SUBJECT NO.: 25 DAY: 0



EEG STATES

SUBJECT NO.: 25 DAY: 1




EEG STATES
SUBJECT NO.: 25 DAY: 2
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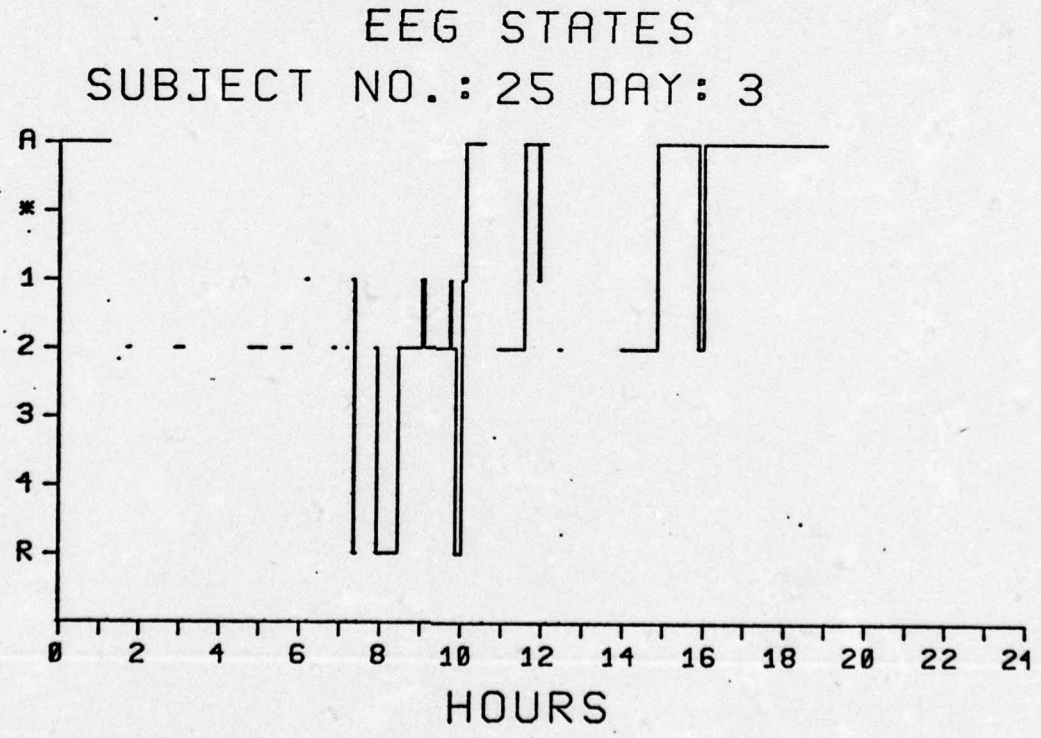
HOURS


EEG STATES
SUBJECT NO.: 25 DAY: 3
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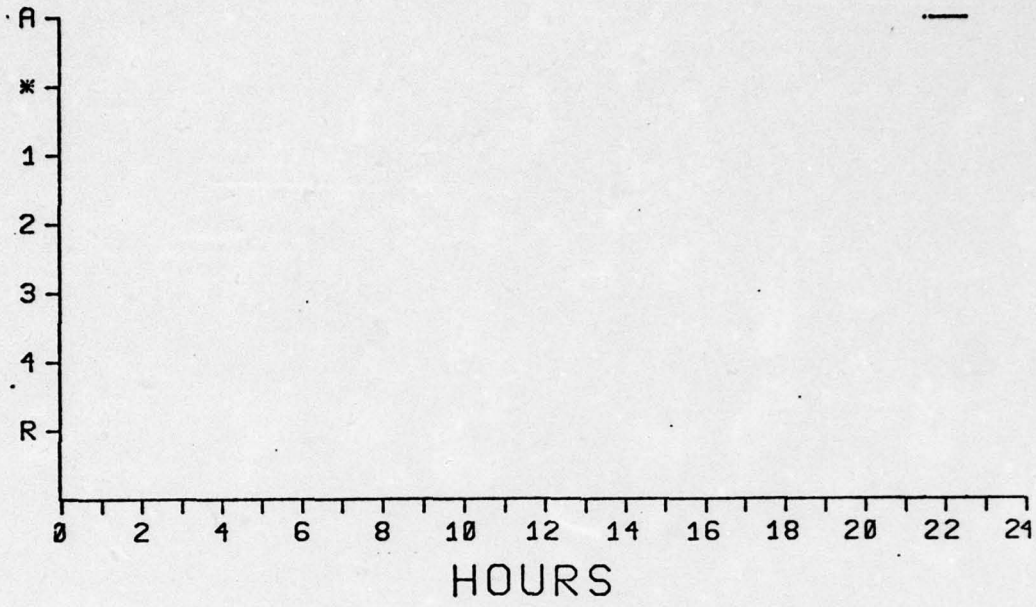
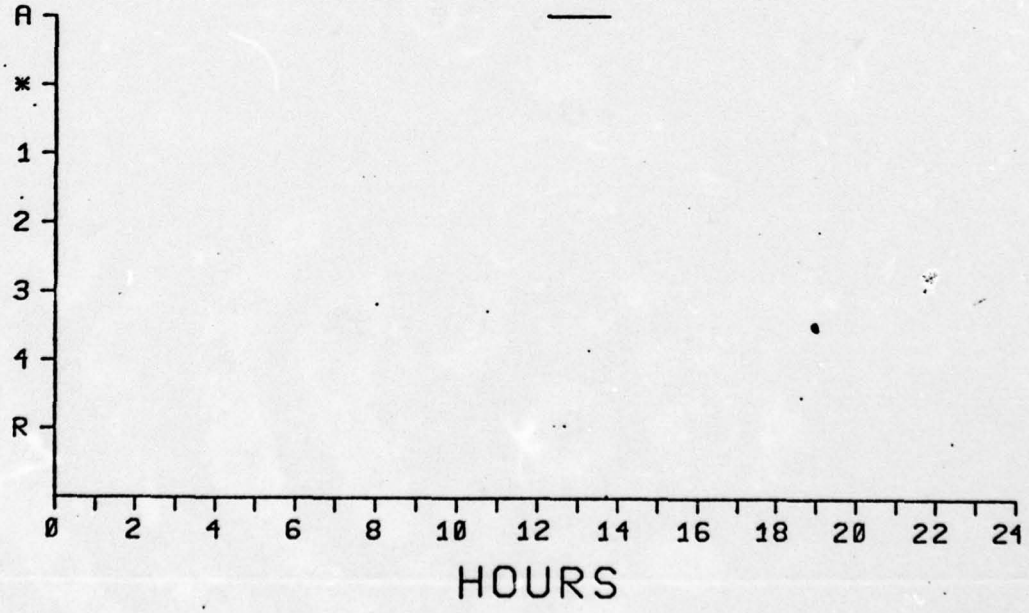
HOURS

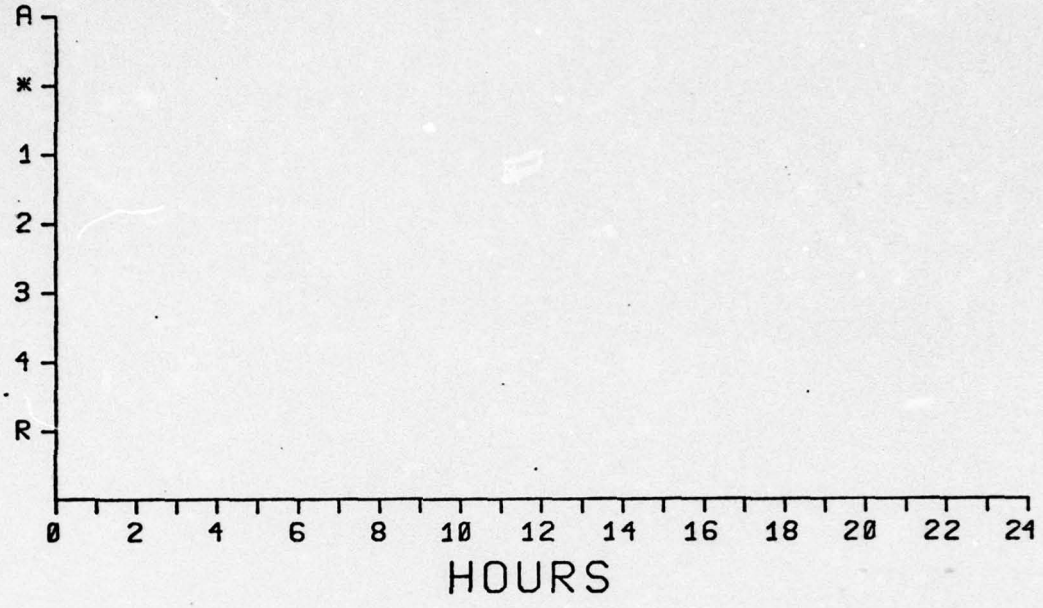
EEG STATES
SUBJECT NO.: 25 DAY: 4



EEG STATES
SUBJECT NO.: 25 DAY: 5



EEG STATES
SUBJECT NO.: 25 DAY: 6



STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	37.36	538.
TOTAL SLEEP	12.64	182.
AWAKE ALPHA	1.53	22.
ONE	5.07	73.
TWO	2.99	43.
THREE	2.08	30.
FOUR	0.97	14.
REM	0.00	0.
UNDEFINED	50.00	720.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	12.09	22.
ONE	40.11	73.
TWO	23.63	43.
THREE	16.48	30.
FOUR	7.69	14.
REM	0.00	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	70.28	1012.
TOTAL SLEEP	29.72	428.
AWAKE ALPHA	6.94	100.
ONE	8.61	124.
TWO	13.26	191.
THREE	0.83	12.
FOUR	0.07	1.
REM	0.00	0.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	23.36	100.
ONE	28.97	124.
TWO	44.63	191.
THREE	2.80	12.
FOUR	0.23	1.
REM	0.00	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 2

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	94.17	1356.
TOTAL SLEEP	5.83	84.
AWAKE ALPHA	2.85	41.
ONE	1.46	21.
TWO	0.56	8.
THREE	0.49	7.
FOUR	0.07	1.
REM	0.42	6.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	48.81	41.
ONE	25.00	21.
TWO	9.52	8.
THREE	8.33	7.
FOUR	1.19	1.
REM	7.14	6.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 3

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	76.25	1098.
TOTAL SLEEP	23.75	342.
AWAKE ALPHA	9.51	137.
ONE	5.07	73.
TWO	5.35	77.
THREE	1.81	26.
FOUR	1.04	15.
REM	0.97	14.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	40.06	137.
ONE	21.35	73.
TWO	22.51	77.
THREE	7.60	26.
FOUR	4.39	15.
REM	4.09	14.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 4

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	78.75	1134.
TOTAL SLEEP	21.25	306.
AWAKE ALPHA	3.06	44.
ONE	7.36	106.
TWO	5.42	78.
THREE	1.46	21.
FOUR	2.78	40.
REM	1.18	17.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	14.38	44.
ONE	34.64	106.
TWO	25.49	78.
THREE	6.86	21.
FOUR	13.07	40.
REM	5.56	17.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 5

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	75.62	1089.
TOTAL SLEEP	24.37	351.
AWAKE ALPHA	5.14	74.
ONE	7.43	107.
TWO	6.18	89.
THREE	1.60	23.
FOUR	2.99	43.
REM	1.04	15.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	21.08	74.
ONE	30.48	107.
TWO	25.36	89.
THREE	6.55	23.
FOUR	12.25	43.
REM	4.27	15.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 6

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	74.58	1074.
TOTAL SLEEP	25.42	366.
AWAKE ALPHA	2.43	35.
ONE	9.51	137.
TWO	9.17	132.
THREE	1.53	22.
FOUR	1.67	24.
REM	1.11	16.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	9.56	35.
ONE	37.43	137.
TWO	36.07	132.
THREE	6.01	22.
FOUR	6.56	24.
REM	4.37	16.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 1
DAY: 7

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	37.15	535.
TOTAL SLEEP	21.60	311.
AWAKE ALPHA	4.10	59.
ONE	4.24	61.
TWO	9.37	135.
THREE	1.46	21.
FOUR	2.43	35.
REM	0.00	0.
UNDEFINED	41.25	594.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	18.97	59.
ONE	19.61	61.
TWO	43.41	135.
THREE	6.75	21.
FOUR	11.25	35.
REM	0.00	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	27.78	400.
TOTAL SLEEP	13.89	200.
AWAKE ALPHA	0.14	2.
ONE	1.74	25.
TWO	7.43	107.
THREE	0.90	13.
FOUR	1.32	19.
REM	2.36	34.
UNDEFINED	58.33	840.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	1.00	2.
ONE	12.50	25.
TWO	53.50	107.
THREE	6.50	13.
FOUR	9.50	19.
REM	17.00	34.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	74.72	1076.
TOTAL SLEEP	25.28	364.
AWAKE ALPHA	1.53	22.
ONE	5.35	77.
TWO	14.17	204.
THREE	1.04	15.
FOUR	0.62	9.
REM	2.57	37.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	6.04	22.
ONE	21.15	77.
TWO	56.04	204.
THREE	4.12	15.
FOUR	2.47	9.
REM	10.16	37.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 2

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	68.68	989.
TOTAL SLEEP	31.32	451.
AWAKE ALPHA	2.43	35.
ONE	5.97	86.
TWO	12.64	182.
THREE	1.94	28.
FOUR	2.22	32.
REM	6.11	88.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	7.76	35.
ONE	19.07	86.
TWO	40.35	182.
THREE	6.21	28.
FOUR	7.10	32.
REM	19.51	88.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 3

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	62.36	898.
TOTAL SLEEP	37.64	542.
AWAKE ALPHA	2.15	31.
ONE	6.32	91.
TWO	15.07	217.
THREE	2.15	31.
FOUR	2.92	42.
REM	9.03	130.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	5.72	31.
ONE	16.79	91.
TWO	40.04	217.
THREE	5.72	31.
FOUR	7.75	42.
REM	23.99	130.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 4

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	65.07	937.
TOTAL SLEEP	34.93	503.
AWAKE ALPHA	1.87	27.
ONE	4.58	66.
TWO	13.61	196.
THREE	2.29	33.
FOUR	1.60	23.
REM	10.97	158.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	5.37	27.
ONE	13.12	66.
TWO	38.97	196.
THREE	6.56	33.
FOUR	4.57	23.
REM	31.41	158.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 5

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	59.44	856.
TOTAL SLEEP	40.56	584.
AWAKE ALPHA	2.78	40.
ONE	4.72	68.
TWO	16.67	240.
THREE	2.29	33.
FOUR	3.19	46.
REM	10.90	157.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	6.85	40.
ONE	11.64	68.
TWO	41.10	240.
THREE	5.65	33.
FOUR	7.88	46.
REM	26.88	157.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 6

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	65.97	950.
TOTAL SLEEP	34.03	490.
AWAKE ALPHA	3.54	51.
ONE	4.72	68.
TWO	12.71	183.
THREE	1.04	15.
FOUR	2.92	42.
REM	9.10	131.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	10.41	51.
ONE	13.88	68.
TWO	37.35	183.
THREE	3.06	15.
FOUR	8.57	42.
REM	26.73	131.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 2
DAY: 7

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	26.53	382.
TOTAL SLEEP	32.22	464.
AWAKE ALPHA	2.43	35.
ONE	4.10	59.
TWO	13.82	199.
THREE	1.74	25.
FOUR	3.12	45.
REM	7.01	101.
UNDEFINED	41.25	594.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	7.54	35.
ONE	12.72	59.
TWO	42.89	199.
THREE	5.39	25.
FOUR	9.70	45.
REM	21.77	101.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 3
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	34.03	490.
TOTAL SLEEP	8.33	120.
AWAKE ALPHA	3.19	46.
ONE	1.81	26.
TWO	1.39	20.
THREE	0.56	8.
FOUR	1.39	20.
REM	0.00	0.
UNDEFINED	57.64	830.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	38.33	46.
ONE	21.67	26.
TWO	16.67	20.
THREE	6.67	8.
FOUR	16.67	20.
REM	0.00	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 3
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	48.61	700.
TOTAL SLEEP	49.93	719.
AWAKE ALPHA	3.68	53.
ONE	5.21	75.
TWO	12.57	181.
THREE	4.65	67.
FOUR	12.50	180.
REM	11.32	163.
UNDEFINED	1.46	21.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	7.37	53.
ONE	10.43	75.
TWO	25.17	181.
THREE	9.32	67.
FOUR	25.03	180.
REM	22.67	163.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 3
DAY: 2

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	65.07	937.
TOTAL SLEEP	34.93	503.
AWAKE ALPHA	6.32	91.
ONE	6.87	99.
TWO	9.79	141.
THREE	2.01	29.
FOUR	4.24	61.
REM	5.69	82.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	18.09	91.
ONE	19.68	99.
TWO	28.03	141.
THREE	5.77	29.
FOUR	12.13	61.
REM	16.30	82.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 3
DAY: 3

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	63.47	914.
TOTAL SLEEP	36.53	526.
AWAKE ALPHA	2.99	43.
ONE	11.53	166.
TWO	12.36	178.
THREE	1.74	25.
FOUR	4.17	60.
REM	3.75	54.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	8.17	43.
ONE	31.56	166.
TWO	33.84	178.
THREE	4.75	25.
FOUR	11.41	60.
REM	10.27	54.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 3
DAY: 4

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	61.74	889.
TOTAL SLEEP	38.26	551.
AWAKE ALPHA	5.42	78.
ONE	5.07	73.
TWO	13.89	200.
THREE	1.60	23.
FOUR	2.92	42.
REM	9.37	135.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	14.16	78.
ONE	13.25	73.
TWO	36.30	200.
THREE	4.17	23.
FOUR	7.62	42.
REM	24.50	135.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 3
DAY: 5

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	23.33	336.
TOTAL SLEEP	27.36	394.
AWAKE ALPHA	3.33	48.
ONE	5.62	81.
TWO	8.89	128.
THREE	1.53	22.
FOUR	4.44	64.
REM	3.54	51.
UNDEFINED	49.31	710.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	12.18	48.
ONE	20.56	81.
TWO	32.49	128.
THREE	5.58	22.
FOUR	16.24	64.
REM	12.94	51.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 6
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	23.12	333.
TOTAL SLEEP	8.12	117.
AWAKE ALPHA	3.82	55.
ONE	1.53	22.
TWO	2.43	35.
THREE	0.28	4.
FOUR	0.07	1.
REM	0.00	0.
UNDEFINED	68.75	990.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	47.01	55.
ONE	18.80	22.
TWO	29.91	35.
THREE	3.42	4.
FOUR	0.85	1.
REM	0.00	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 6
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	53.06	764.
TOTAL SLEEP	46.94	676.
AWAKE ALPHA	5.62	81.
ONE	9.79	141.
TWO	24.03	346.
THREE	0.83	12.
FOUR	2.15	31.
REM	4.51	65.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	11.98	81.
ONE	20.86	141.
TWO	51.18	346.
THREE	1.78	12.
FOUR	4.59	31.
REM	9.62	65.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 6
DAY: 2

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	60.76	875.
TOTAL SLEEP	39.24	565.
AWAKE ALPHA	9.65	139.
ONE	9.17	132.
TWO	16.04	231.
THREE	1.25	18.
FOUR	0.69	10.
REM	2.43	35.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	24.60	139.
ONE	23.36	132.
TWO	40.88	231.
THREE	3.19	18.
FOUR	1.77	10.
REM	6.19	35.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 6
DAY: 3

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	58.19	838.
TOTAL SLEEP	41.81	602.
AWAKE ALPHA	6.74	97.
ONE	9.51	137.
TWO	21.39	308.
THREE	0.49	7.
FOUR	1.53	22.
REM	2.15	31.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	16.11	97.
ONE	22.76	137.
TWO	51.16	308.
THREE	1.16	7.
FOUR	3.65	22.
REM	5.15	31.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 6
DAY: 4

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	54.65	787.
TOTAL SLEEP	45.35	653.
AWAKE ALPHA	9.72	140.
ONE	13.75	198.
TWO	18.89	272.
THREE	1.25	18.
FOUR	1.25	18.
REM	0.49	7.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	21.44	140.
ONE	30.32	198.
TWO	41.65	272.
THREE	2.76	18.
FOUR	2.76	18.
REM	1.07	7.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 6
DAY: 5

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	71.81	1034.
TOTAL SLEEP	28.19	406.
AWAKE ALPHA	10.00	144.
ONE	6.18	89.
TWO	9.24	133.
THREE	1.04	15.
FOUR	0.42	6.
REM	1.32	19.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	35.47	144.
ONE	21.92	89.
TWO	32.76	133.
THREE	3.69	15.
FOUR	1.48	6.
REM	4.68	19.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 6
DAY: 6

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	7.71	111.
TOTAL SLEEP	20.69	298.
AWAKE ALPHA	3.12	45.
ONE	4.72	68.
TWO	9.65	139.
THREE	1.25	18.
FOUR	1.32	19.
REM	0.62	9.
UNDEFINED	71.60	1031.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	15.18	45.
ONE	22.82	68.
TWO	46.64	139.
THREE	6.04	18.
FOUR	6.38	19.
REM	3.02	9.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 9
DAY: 8

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	21.67	312.
TOTAL SLEEP	15.97	230.
AWAKE ALPHA	1.87	27.
ONE	1.46	21.
TWO	5.62	81.
THREE	1.67	24.
FOUR	3.12	45.
REM	2.22	32.
UNDEFINED	62.36	898.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	11.74	27.
ONE	9.13	21.
TWO	35.22	81.
THREE	10.43	24.
FOUR	19.57	45.
REM	13.91	32.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 9
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	43.06	620.
TOTAL SLEEP	33.68	485.
AWAKE ALPHA	3.26	47.
ONE	4.24	61.
TWO	16.46	237.
THREE	0.76	11.
FOUR	2.36	34.
REM	6.60	95.
UNDEFINED	23.26	335.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	9.69	47.
ONE	12.58	61.
TWO	48.87	237.
THREE	2.27	11.
FOUR	7.01	34.
REM	19.59	95.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	7.64	110.
TOTAL SLEEP	0.00	0.
AWAKE ALPHA	0.00	0.
ONE	0.00	0.
TWO	0.00	0.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.
UNDEFINED	92.36	1330.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	*****	0.
ONE	*****	0.
TWO	*****	0.
THREE	*****	0.
FOUR	*****	0.
REM	*****	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	61.11	880.
TOTAL SLEEP	8.61	124.
AWAKE ALPHA	1.46	21.
ONE	1.18	17.
TWO	1.94	28.
THREE	1.18	17.
FOUR	2.85	41.
REM	0.00	0.
UNDEFINED	30.28	436.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	16.94	21.
ONE	13.71	17.
TWO	22.58	28.
THREE	13.71	17.
FOUR	33.06	41.
REM	0.00	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 2

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	72.01	1037.
TOTAL SLEEP	27.99	403.
AWAKE ALPHA	3.06	44.
ONE	3.33	48.
TWO	15.00	216.
THREE	1.25	18.
FOUR	1.25	18.
REM	4.10	59.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	10.92	44.
ONE	11.91	48.
TWO	53.60	216.
THREE	4.47	18.
FOUR	4.47	18.
REM	14.64	59.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 3

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	69.51	1001.
TOTAL SLEEP	30.49	439.
AWAKE ALPHA	2.71	39.
ONE	3.68	53.
TWO	15.14	218.
THREE	2.99	43.
FOUR	2.57	37.
REM	3.40	49.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	8.88	39.
ONE	12.07	53.
TWO	49.66	218.
THREE	9.79	43.
FOUR	8.43	37.
REM	11.16	49.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 4

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	68.96	993.
TOTAL SLEEP	31.04	447.
AWAKE ALPHA	2.36	34.
ONE	4.31	62.
TWO	13.96	201.
THREE	1.74	25.
FOUR	3.19	46.
REM	5.49	79.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	7.61	34.
ONE	13.87	62.
TWO	44.97	201.
THREE	5.59	25.
FOUR	10.29	46.
REM	17.67	79.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 5

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	15.35	221.
TOTAL SLEEP	19.10	275.
AWAKE ALPHA	1.67	24.
ONE	1.53	22.
TWO	7.57	109.
THREE	1.04	15.
FOUR	2.36	34.
REM	4.93	71.
UNDEFINED	65.56	944.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	8.73	24.
ONE	8.00	22.
TWO	39.64	109.
THREE	5.45	15.
FOUR	12.36	34.
REM	25.82	71.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 6

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	15.35	221.
TOTAL SLEEP	19.10	275.
AWAKE ALPHA	1.67	24.
ONE	1.53	22.
TWO	7.57	109.
THREE	1.04	15.
FOUR	2.36	34.
REM	4.93	71.
UNDEFINED	65.56	944.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	8.73	24.
ONE	8.00	22.
TWO	39.64	109.
THREE	5.45	15.
FOUR	12.36	34.
REM	25.82	71.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 0 F

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	8.33	120.
TOTAL SLEEP	0.00	0.
AWAKE ALPHA	0.00	0.
ONE	0.00	0.
TWO	0.00	0.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.
UNDEFINED	91.67	1320.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	*****	0.
ONE	*****	0.
TWO	*****	0.
THREE	*****	0.
FOUR	*****	0.
REM	*****	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 1 F

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	4.10	59.
TOTAL SLEEP	36.04	519.
AWAKE ALPHA	3.68	53.
ONE	4.51	65.
TWO	19.86	286.
THREE	1.11	16.
FOUR	3.47	50.
REM	3.40	49.
UNDEFINED	59.86	862.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	10.21	53.
ONE	12.52	65.
TWO	55.11	286.
THREE	3.08	16.
FOUR	9.63	50.
REM	9.44	49.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 2 F

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	8.68	125.
TOTAL SLEEP	0.07	1.
AWAKE ALPHA	0.07	1.
ONE	0.00	0.
TWO	0.00	0.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.
UNDEFINED	91.25	1314.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	*****	1.
ONE	0.00	0.
TWO	0.00	0.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 11
DAY: 3 F

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	1.53	22.
TOTAL SLEEP	41.04	591.
AWAKE ALPHA	3.82	55.
ONE	5.49	79.
TWO	19.79	285.
THREE	1.39	20.
FOUR	4.31	62.
REM	6.25	90.
UNDEFINED	57.43	827.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	9.31	55.
ONE	13.37	79.
TWO	48.22	285.
THREE	3.38	20.
FOUR	10.49	62.
REM	15.23	90.

STATE PERCENTAGES & TIME IN MINUTES FOR:

SUBJECT NO.: 16
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	22.85	329.
TOTAL SLEEP	18.89	272.
AWAKE ALPHA	1.60	23.
ONE	2.43	35.
TWO	7.22	104.
THREE	2.01	29.
FOUR	4.37	63.
REM	1.25	18.
UNDEFINED	58.26	839.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	8.46	23.
ONE	12.87	35.
TWO	38.24	104.
THREE	10.66	29.
FOUR	23.16	63.
REM	6.62	18.

STATE PERCENTAGES & TIME IN MINUTES FOR:

SUBJECT NO.: 16
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	24.72	356.
TOTAL SLEEP	31.57	456.
AWAKE ALPHA	2.08	30.
ONE	4.24	61.
TWO	15.83	228.
THREE	2.22	32.
FOUR	0.35	5.
REM	6.94	100.
UNDEFINED	43.61	628.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	6.58	30.
ONE	13.38	61.
TWO	50.00	228.
THREE	7.02	32.
FOUR	1.10	5.
REM	21.93	100.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 18
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	4.72	68.
TOTAL SLEEP	29.03	418.
AWAKE ALPHA	5.69	82.
ONE	2.64	38.
TWO	15.00	216.
THREE	1.67	24.
FOUR	0.07	1.
REM	3.96	57.
UNDEFINED	66.25	954.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	19.62	82.
ONE	9.09	38.
TWO	51.67	216.
THREE	5.74	24.
FOUR	0.24	1.
REM	13.64	57.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 18
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	12.78	184.
TOTAL SLEEP	45.62	657.
AWAKE ALPHA	7.85	113.
ONE	3.96	57.
TWO	22.50	324.
THREE	2.43	35.
FOUR	1.46	21.
REM	7.43	107.
UNDEFINED	41.60	599.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	17.20	113.
ONE	8.68	57.
TWO	49.32	324.
THREE	5.33	35.
FOUR	3.20	21.
REM	16.29	107.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 19
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	31.74	457.
TOTAL SLEEP	2.01	29.
AWAKE ALPHA	0.76	11.
ONE	0.35	5.
TWO	0.90	13.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.
UNDEFINED	66.25	954.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	37.93	11.
ONE	17.24	5.
TWO	44.83	13.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 19
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	62.50	900.
TOTAL SLEEP	37.50	540.
AWAKE ALPHA	2.22	32.
ONE	3.89	56.
TWO	22.92	330.
THREE	1.74	25.
FOUR	3.33	48.
REM	3.40	49.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	5.93	32.
ONE	10.37	56.
TWO	61.11	330.
THREE	4.63	25.
FOUR	8.89	48.
REM	9.07	49.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 19
DAY: 2

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	62.15	895.
TOTAL SLEEP	37.85	545.
AWAKE ALPHA	4.93	71.
ONE	5.21	75.
TWO	19.58	282.
THREE	2.36	34.
FOUR	0.62	9.
REM	5.14	74.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	13.03	71.
ONE	13.76	75.
TWO	51.74	282.
THREE	6.24	34.
FOUR	1.65	9.
REM	13.58	74.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 19
DAY: 3

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	62.29	897.
TOTAL SLEEP	37.71	543.
AWAKE ALPHA	1.60	23.
ONE	4.10	59.
TWO	23.61	340.
THREE	1.18	17.
FOUR	0.62	9.
REM	6.60	95.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	4.24	23.
ONE	10.87	59.
TWO	62.62	340.
THREE	3.13	17.
FOUR	1.66	9.
REM	17.50	95.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 19
DAY: 4

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	61.94	892.
TOTAL SLEEP	38.06	548.
AWAKE ALPHA	4.93	71.
ONE	5.28	76.
TWO	19.37	279.
THREE	1.81	26.
FOUR	1.60	23.
REM	5.07	73.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	12.96	71.
ONE	13.87	76.
TWO	50.91	279.
THREE	4.74	26.
FOUR	4.20	23.
REM	13.32	73.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 19
DAY: 5

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	26.46	381.
TOTAL SLEEP	28.06	404.
AWAKE ALPHA	2.85	41.
ONE	2.64	38.
TWO	14.44	208.
THREE	2.29	33.
FOUR	2.64	38.
REM	3.19	46.
UNDEFINED	45.49	655.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	10.15	41.
ONE	9.41	38.
TWO	51.49	208.
THREE	8.17	33.
FOUR	9.41	38.
REM	11.39	46.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 25
DAY: 0

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	23.89	344.
TOTAL SLEEP	0.00	0.
AWAKE ALPHA	0.00	0.
ONE	0.00	0.
TWO	0.00	0.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.
UNDEFINED	76.11	1096.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	*****	0.
ONE	*****	0.
TWO	*****	0.
THREE	*****	0.
FOUR	*****	0.
REM	*****	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 25
DAY: 1

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	64.86	934.
TOTAL SLEEP	35.14	506.
AWAKE ALPHA	0.83	12.
ONE	5.00	72.
TWO	19.79	285.
THREE	1.18	17.
FOUR	0.97	14.
REM	7.36	106.
UNDEFINED	0.00	0.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	2.37	12.
ONE	14.23	72.
TWO	56.32	285.
THREE	3.36	17.
FOUR	2.77	14.
REM	20.95	106.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 25
DAY: 2

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	58.47	842.
TOTAL SLEEP	31.81	458.
AWAKE ALPHA	1.18	17.
ONE	3.54	51.
TWO	18.96	273.
THREE	1.11	16.
FOUR	0.56	8.
REM	6.46	93.
UNDEFINED	9.72	140.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	3.71	17.
ONE	11.14	51.
TWO	59.61	273.
THREE	3.49	16.
FOUR	1.75	8.
REM	20.31	93.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 25
DAY: 3

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	25.35	365.
TOTAL SLEEP	22.71	327.
AWAKE ALPHA	0.35	5.
ONE	3.06	44.
TWO	16.25	234.
THREE	0.00	0.
FOUR	0.00	0.
REM	3.06	44.
UNDEFINED	51.94	748.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	1.53	5.
ONE	13.46	44.
TWO	71.56	234.
THREE	0.00	0.
FOUR	0.00	0.
REM	13.46	44.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 25
DAY: 4

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	4.24	61.
TOTAL SLEEP	0.00	0.
AWAKE ALPHA	0.00	0.
ONE	0.00	0.
TWO	0.00	0.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.
UNDEFINED	95.76	1379.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	*****	0.
ONE	*****	0.
TWO	*****	0.
THREE	*****	0.
FOUR	*****	0.
REM	*****	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 25
DAY: 5

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	6.46	93.
TOTAL SLEEP	0.00	0.
AWAKE ALPHA	0.00	0.
ONE	0.00	0.
TWO	0.00	0.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.
UNDEFINED	93.54	1347.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	*****	0.
ONE	*****	0.
TWO	*****	0.
THREE	*****	0.
FOUR	*****	0.
REM	*****	0.

STATE PERCENTAGES & TIME IN MINUTES FOR:
SUBJECT NO.: 25
DAY: 6

	PER CENT	TIME
BASED ON 24 HOURS		
AWAKE	0.00	0.
TOTAL SLEEP	0.00	0.
AWAKE ALPHA	0.00	0.
ONE	0.00	0.
TWO	0.00	0.
THREE	0.00	0.
FOUR	0.00	0.
REM	0.00	0.
UNDEFINED	*****	1440.
BASED ON TOTAL SLEEP ONLY		
AWAKE ALPHA	*****	0.
ONE	*****	0.
TWO	*****	0.
THREE	*****	0.
FOUR	*****	0.
REM	*****	0.

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